Vector Supercomputers from Japan

Investigation No. 731-TA-750 (Final)

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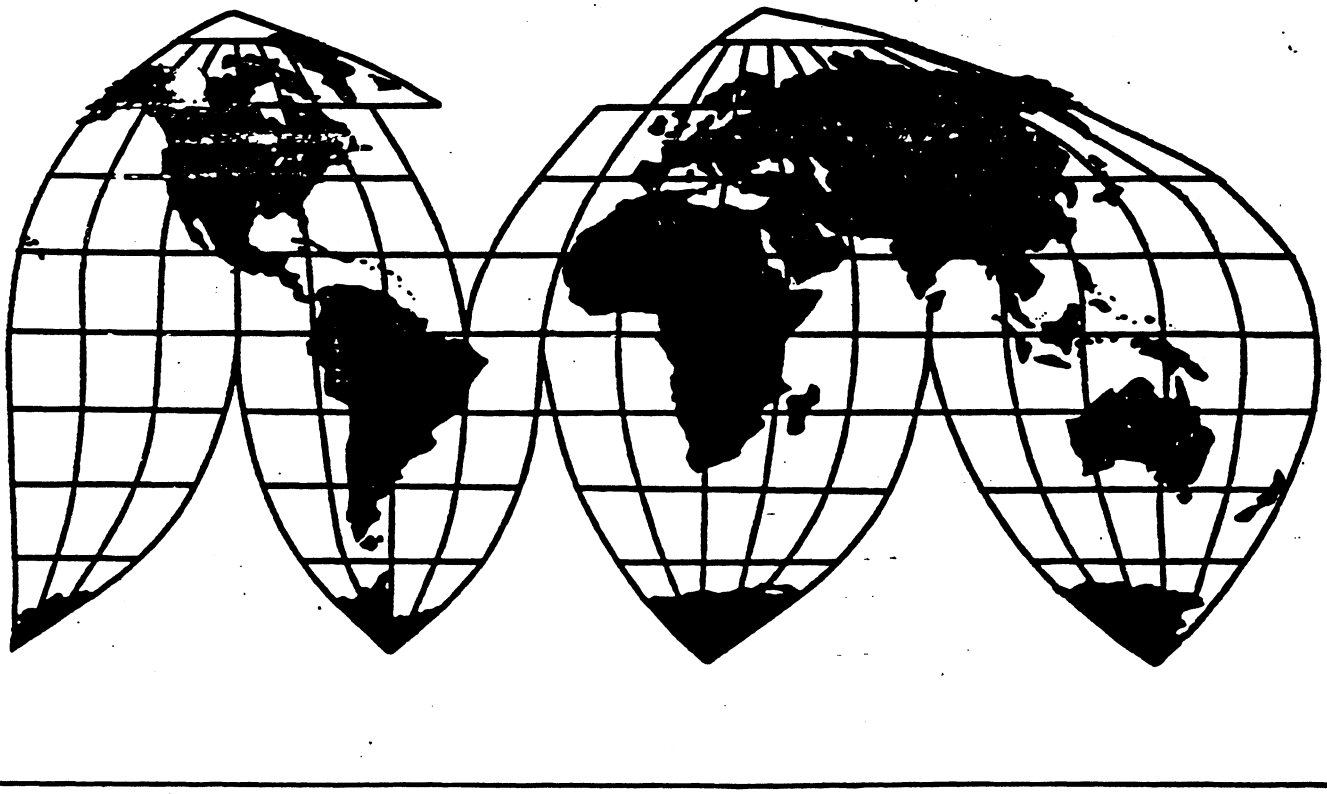

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U.S. International Trade Commission

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Vector Supercomputers from Japan

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CONTENTS

i

CONTENTS

Appendixes

Figures

ii

CONTENTS

CONTENTS

CONTENTS

Note.--Information that would reveal confidential operations of individual conerns may not be published and therefore has been deleted from this report. Such deletions are indicated by asterisks.

GLOSSARY OF ABBREVIATIONS

AES	Atmospheric Environmental Service
Alliant	Alliant Computer Systems
Alta	Alta Technologies
American	American Supercomputers
ASCI	DOE's Accelerated Strategic Computing Initiative
ASL	Automotive Systems Laboratory
ATM	Asynchronous transfer mode
BAFO	Best and final offer
BAPL	Bettis Atomic Power Laboratory
BSD	Business Systems Division
CCC	Cray Computer Corporation
CC-NUMA	Cache-coherent non-uniform memory architecture
Celerity	Celerity Computing
Chopp	Chopp Computer
CMOS	Complimentary metal oxide semiconductor
Commerce	U.S. Department of Commerce
Commission	U.S. International Trade Commission
Convex	Convex Technology Center of Hewlett Packard
COTS	Commercial off the shelf
CPU	Central processing unit
CRI	Cray Research, Inc.
Culler	Culler Scientific Systems
DEC	Digital Equipment Corporation
DEC PVM	Digital's parallel virtual machine
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy
DRAM	Dynamic random access memory
DSM	Distributed shared memory
ECL	Emitter coupled logic
ETA	ETA Systems
FCMC	Fuji Capital Markets Corporation
FCC	Federal Computer Corporation
FDDI	Fiber distributed data interface
FFT	Fast Fourier Transforms
Floating Point	Floating Point Systems
Fujitsu	Fujitsu Limited or Fujitsu America
GB or Gbytes	Gigabytes
Gflops	Gigaflops (billions of floating point operations per second)
GIT	Georgia Institute of Technology
GTRI	Geotechnology Research Institute
HARC	Houston Advanced Research Center
HNSX	HNSX Supercomputer, Inc.
HP	Hewlett-Packard

vi

HPC	High-performance computing
HPMR	High performance midrange
HPTC	High performance technical computing
HTS	Harmonized Tariff Schedule of the United States
IBM	International Business Machines
IDC	International Data Corporation
Intel	Intel Corporation
I/O	Input/output
ISV	Independent software vendors
KAPL	Knolls Atomic Power Laboratory
Key	Key Computer
KSR	Kendall Square Research
LAN	Local area network
LLNL	Lawrence Livermore National Laboratory
LTD	Live test demonstration
LTFV	Less than fair value
MB or Mbytes	Megabytes
Merck	Merck and Company, Inc.
Mflops	Megaflops (millions of floating point operations per second)
MHPCC	Maui High Performance Computing Center
MPP	Massively parallel processor
MSC	Minnesota Supercomputer Center
Multi-Flow	Multi-Flow Computer
MVS	Multiple virtual storage
NAO	National Astronomical Observatory, Japan
NASA	National Aeronautics and Space Agency
NAVO	National Oceanographic Office
NCAR	National Center for Atmospheric Research
NCEP	National Centers for Environmental Prediction
NCSA	National Center for Supercomputing Applications
NCR	National Cash Register
NCSA	National Center for Supercomputing Applications
NEC	NEC Corporation and NEC Systems Laboratory
NIST	National Institute of Standards and Technology
NOAA/GFDL	NOAA/Geophysical Fluid Dynamics Laboratory
NOW	Network of workstations
NSA	National Security Agency
NSF	National Science Foundation
NTT	Nippon Telephone and Telegraph
ORNL	Oak Ridge National Laboratory
PE	Processing element
PSC	Pittsburgh Supercomputing Center
PVP	Parallel vector processing
R&D	Research and development expenses
RFP	Request for proposal

vii

Richter	Richter Paradigm Corporation
RISC	Reduced instruction set computer
Rmax	Maximum achieved performance
Sandia	Sandia National Laboratories
Saxpy	Saxpy Computer
Scientific Computer	Scientific Computer Systems
Sequent	Sequent Computer Systems, Inc.
SG&A	Selling, general & administrative expenses
SGI	Silicon Graphics, Inc.
Siemens Pyramid	Siemens Pyramid Information Systems
SMP	Symmetric multiprocessor
SPP	Scalable parallel processing
SRAM	Static random access memory
SSD	Intel's Scalable Systems Division
SSG	Scalable Systems Group
Sun	Sun Microsystems
Tandem	Tandem Computers, Inc.
Tera	Tera Computer Company
TMC	Thinking Machines Corporation
TRC	Trade Resources Company
UCAR	University Corporation for Atmospheric Research
Unisys	Unisys Corporation
U.S. ARL	U.S. Army Research Laboratory
WAN	Wide area network

viii

UNITED STATES INTERNATIONAL TRADE COMMISSION

Investigation No. 731-TA-750 (Final)

VECTOR SUPERCOMPUTERS FROM JAPAN

DETERMINATION

On the basis of the record[1] developed in the subject investigation, the United States International Trade Commission determines,[2] pursuant to section 735(b) of the Tariff Act of 1930 (19 U.S.C. § 1673d(b)) (the Act), that an industry in the United States is threatened with material injury by reason of imports from Japan of vector supercomputers, provided for in heading 8471 of the Harmonized Tariff Schedule of the United States, that have been found by the Department of Commerce to be sold in the United States at less than fair value (LTFV).[3]

BACKGROUND

The Commission instituted this investigation effective July 29, 1996, following receipt of a petition filed with the Commission and the Department of Commerce by Cray Research, Inc., Eagan, MN. The final phase of the investigation was scheduled by the Commission following notification of a preliminary determination by the Department of Commerce that imports of vector supercomputers from Japan were being sold at LTFV within the meaning of section 733(b) of the Act (19 U.S.C. § 1673b(b)). Notice of the scheduling of the Commission's investigation and of a public hearing to be held in connection therewith was given by posting copies of the notice in the Office of the Secretary, U.S. International Trade Commission, Washington, DC, and by publishing the notice in the *Federal Register* of May 7, 1997 (62 FR 24973). The hearing was held in Washington, DC, on August 27, 1997, and all persons who requested the opportunity were permitted to appear in person or by counsel.

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[1] The record is defined in sec. 207.2(f) of the Commission's Rules of Practice and Procedure (19 CFR § 207.2(f)).

[2] Commissioner Crawford not participating.

[3] The Commission further determines, pursuant to 19 U.S.C. § 1673d(b)(4)(B), that it would not have found material injury but for the suspension of liquidation of entries of the merchandise under investigation.

VIEWS OF THE COMMISSION

Based on the record in this investigation, we find that the industry producing vector supercomputers in the United States is threatened with material injury by reason of imports of vector supercomputers from Japan that are sold in the United States at less than fair value ("LTFV").[1]

I. DOMESTIC LIKE PRODUCT AND DOMESTIC INDUSTRY

A. In General

To determine whether an industry in the United States is materially injured or threatened with material injury by reason of the subject imports, the Commission first defines the "domestic like product" and the "industry." Section 771(4)(A) of the Tariff Act of 1930, as amended ("the Act"), defines the relevant industry as the "producers as a [w]hole of a domestic like product, or those producers whose collective output of a domestic like product constitutes a major proportion of the total domestic production of the product."[2] In turn, the Act defines "domestic like product" as "a product which is like, or in the absence of like, most similar in characteristics and uses with, the article subject to an investigation."[3]

Our decision regarding the appropriate domestic like product(s) in an investigation is a factual determination, and we apply the statutory standard of "like" or "most similar in characteristics and uses" on a case-by-case basis.[4] No single factor is dispositive, and the Commission may consider other factors it deems relevant based on the facts of a particular investigation.[5] The Commission looks for clear dividing lines among possible like products, and disregards minor variations.[6] Although the Commission must accept the determination of Commerce as to the scope of the imported merchandise sold at LTFV, the Commission determines what domestic product is like the imported articles Commerce has identified.[7]

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[1] Commissioner Crawford did not participate in this investigation.

[2] 19 U.S.C. § 1677(4)(A).

[3] 19 U.S.C. § 1677(10).

[4] *See, e.g.*, Nippon Steel Corp. v. United States, 19 CIT __, Slip Op. 95-57 at 11 (Apr. 3, 1995). The Commission generally considers a number of factors including: (1) physical characteristics and uses; (2) interchangeability; (3) channels of distribution; (4) common manufacturing facilities, production processes and production employees; (5) customer and producer perceptions; and, where appropriate, (6) price. *See id.* at 11 n.4; Timken Co. v. United States, 913 F. Supp. 580, 584 (Ct. Int'l Trade 1996).

[5] *See, e.g.*, S. Rep. No. 249, 96th Cong., 1st Sess. 90-91 (1979).

[6] Torrington Co. v. United States, 747 F. Supp. 744, 748-49 (Ct. Int'l Trade 1990), *aff'd*, 938 F.2d 1278 (Fed. Cir. 1991).

[7] Hosiden Corp. v. Advanced Display Manufacturers, 85 F.3d 1561 (Fed. Cir. 1996) (Commission may find single like product corresponding to several different classes or kinds defined by Commerce); Torrington, 747 F. Supp. at 748-752 (affirming Commission determination of six like products in investigations where Commerce found five classes or kinds).

B. Products Covered by the Scope of the Investigation

In its final determination, Commerce defined the articles subject to this investigation as follows: [a]ll vector supercomputers, whether new or used, and whether in assembled or unassembled form, as well as vector supercomputer spare parts, repair parts, upgrades, and system software shipped to fulfill the requirements of a contract entered into on or after April 7, 1997, for the sale and, if included, maintenance of a vector supercomputer. A vector supercomputer is any computer with a vector hardware unit as an integral part of its central processing unit boards.[8]

C. Domestic Like Product

The parties argued one domestic like product issue in this investigation: whether the domestic like product, in addition to including vector supercomputers, should also include supercomputers which do not contain vector processors, such as massively parallel processors (MPPs), scalable parallel processors (SPPs) and /or symmetric multiprocessors (SMPs). For purposes of this opinion, we refer collectively to these other supercomputers as non-vector supercomputers. Petitioner[9] argued that the domestic like product is limited to vector supercomputers, whereas respondents[10] argued that the domestic like product includes all supercomputers.

In the preliminary phase of this investigation, we determined that the domestic like product was vector supercomputers, commensurate with Commerce's scope.[11] We indicated, however, that we would reexamine closely the definition of the domestic like product in any final investigation.

Supercomputers are generally differentiated from other computers by two factors--higher processing speeds and the ability to handle numerically intensive problems too large for conventional computers. Both speed and size are relative terms, however, and the constant evolution of all computers in general and supercomputers in particular makes a concrete, measurable differentiation between these products difficult. Another general distinction that supercomputers possess is a low latency, high bandwidth interconnect, which allows rapid communication or message passing among processors.[12]

Supercomputers can be divided into two main categories: vector supercomputers and various types of parallel systems (non-vector systems).[13] Vector supercomputers are designed to perform operations on sets of numbers called vectors. The processor treats each vector as a single entity; thus, performing an operation on a set of numbers arranged in a vector array requires only one instruction. This aspect is particularly well suited to simulating complex problems over time, for example the operation of a jet engine from take off to landing or climate changes spanning decades.[14]

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[8] 62 Fed. Reg. 45264 (August 28, 1997).

[9] The petitioner in this investigation is Cray Research, Inc. (hereinafter "CRI," "Cray," or "Petitioner").

[10] The respondents in this investigation are Fujitsu Limited and Fujitsu America, Inc. (hereinafter "Fujitsu") and NEC Corporation and HNSX Supercomputers Inc. (hereinafter "NEC"). Fujitsu and NEC are also collectively referred to as "Respondents."

[11] USITC Pub. 2993 at 4-8.

[12] Confidential Report ("CR") at I-3, Public Report ("PR") at I-2-3.

[13] CR at I-6, PR at I-4.

[14] CR at I-10-11, PR at I-6-7.

Non-vector supercomputers utilize multiple parallel processors to process data. The number of processors can range from a few to many (a characteristic known as scalability). Part of the overall program and the corresponding data are assigned to each processor and all processors carry out the required calculations simultaneously.[15] A routing network allows the computers to communicate with each other. Because message passing can slow the machine's overall speed, parallel processing is best suited to problems with many small parts that can be computed independently.[16]

For the reasons discussed below, we find that the domestic like product consists of only vector supercomputers.

I. Physical Characteristics and Uses

Depending on the criteria applied, supercomputers have been characterized by performance level, number of processors, type of processor, type of information or instruction flow, memory structure, interconnection or communications technology, or some combination of these and other distinctions. Petitioner distinguishes supercomputer architectures based on processor hardware -- vector versus non-vector -- whereas respondents advocate a classification based on system memory structure (distributed versus shared).[17] We note that the study upon which Fujitsu and NEC rely also characterized the machines by processor hardware, as either vector or parallel machines,[18] as did the literature provided by respondents from International Data Corporation (IDC).[19]

We find that the presence or absence of a vector processor imparts an important and clear physical characteristic to a supercomputer. Vector supercomputers have hardware specially designed to process data in groups called vectors, whereas non-vector machines process data in parallel. Most vector supercomputers have one large shared memory [20] and programming is specially designed to minimize the time required to bring needed data from memory to processors and to the appropriate output device. Another characteristic that differentiates vector supercomputers from non-vector supercomputers is the presence of custom processing elements that number only in the 10s,[21] whereas in non-vector

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[15] CR at I-6, PR at I-4.

[16] CR at I-6, PR at I-4.

[17] CR at I-10, PR at I-4. Respondents argue that all supercomputers share a set of essential physical characteristics, and assert that a standard taxonomy of supercomputers recognizes two types of supercomputer architecture: SIMD (single instruction multiple data) and MIMD (multiple instruction multiple data). The SIMD and MIMD categories are further divided into systems with shared memory (SM) and systems with distributed memory (DM), yielding a total of four architectural types, SM-SIMD, DM-SIMD, SM-MIMD, and DM-MIMD. NEC's Prehearing Brief at 11. Respondents argue that in two of these three categories, vector systems are classified with non-vector systems. Hence, NEC concludes that the presence of vector processors is peripheral to the categorization of supercomputers in terms of physical characteristics. *E.g.*, NEC's Prehearing Brief at 10-15.

[18] *See*, van der Steen, Overview of Recent Computers, Publication of the NCF (January 1997) reproduced at Exhibit 3 to NEC's Prehearing Brief (discussing and designating machine type as "vector processors").

[19] *See* Fujitsu's Prehearing Brief at Exhibit 1, Fujitsu's Posthearing Brief at Exhibit 1. Fujitsu argues that numerous studies conducted by IDC routinely divide the supercomputer market into three areas: supercomputers, which include high-end vector machines; high performance mid-range (which includes vector and MPP machines); and technical parallel processors. Fujitsu's Prehearing Brief at 9-13.

[20] Fujitsu vector supercomputers do not have a shared memory, but do use vector processing. CR at I-11, PR at I-7.

[21] CR at I-11, PR at I-7.

supercomputers the processing units can number in the hundreds.[22] Vector hardware allows processing of many data items as a group rather than as individual items. This hardware also permits the system to operate on more than one instruction at the same time. Vector supercomputers generally use custom logic chips,[23] whereas non-vector supercomputers often use commodity chips with little or no customization.[24]

In contrast, non-vector systems vary widely among themselves in architecture, performance, and applications and encompass a broad array of products. The distinguishing characteristics include the internal communications systems, memory structure, and the number of instruction units that communicate with the processing elements. These differences prevent programming for one type of parallel processing computer from being compatible with other configurations. Non-vector supercomputers have in common, however, multiple processing elements, and, as noted above, unlike vector processors often use commodity logic chips with little or no customization.[25]

Although all supercomputers are generally used for the same purposes, i.e., to perform complex calculations, even respondents concede for certain end use applications a vector supercomputer provides the best computing solutions.[26] Supercomputers, regardless of architecture, are widely used in government and industrial research. Responses to the Commission's producer and importer questionnaires indicate that both vector and non-vector supercomputers are currently employed in 15 of 20 specific end-use/application categories.[27] However, as discussed in the following section, there are some areas even within end-use categories in which shifting from a vector to a non-vector supercomputer involves considerable difficulty and mixed performance results.[28] The fact that end-users reported purchasing both vector and non-vector systems at the same time further suggests that the different systems provide distinct benefits.[29]

II. Interchangeability

All parties agree that a core base of customers exists for whom vector supercomputer systems provide the only feasible solution to their computing needs.[30] The focus of the parties' arguments, however, has been the size of this core base, the extent of interchangeability and competition between vector and non-vector supercomputers in the rest of the market.[31] [32]

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[22] CR at I-13, PR at I-8.

[23] CR at I-15, PR at I-9.

[24] CR at I-11, PR at I-7.

[25] CR at I-11, PR at I-7.

[26] *E.g.*, NEC's Prehearing Brief at 16 and 25, CRI's Posthearing Brief at Exhibit 1, Fujitsu's Posthearing Brief, Answers to Commission Questions at 3-4 and 19-20, Meeting with *** Sept. 8, 1997.

[27] CR at II-14, PR at II-6. The specific end-use categories are listed in CR at II-14, n.24, CR at II-6, n.24.

[28] *E.g.*, CR at II-14-20, PR at II-6-8 .

[29] *See*, Fujitsu's Prehearing Brief at Exhibit 15. *See also* CR at V-31, PR at V-6. ***; http://www.cray.com/solutions/customers/noaa.html (Aug. 22, 1997) (Geophysical Fluid Dynamics Laboratory (GFDL) procured a vector and an MPP at the same time).

[30] CR at I-20, PR at I-12, and citations therein.

[31] Petitioner maintains that most customers buy vector supercomputers because their applications do not run at an acceptable level on non-vector systems and the effort required to transport proprietary software is too great. Petitioner provided an analysis of various industrial applications (automotive, chemical and aerospace) to show that these industries depend on vector processing for certain applications. While acknowledging that third-party software applications can be run on different platforms, petitioner argues that the proper question is how well they

Much of the competition between vector supercomputers and non-vector supercomputers appears to be among "mid-range" supercomputers,[33] and the record indicates that non-vector supercomputers can replicate vector supercomputers in some mid-range applications. Conversely, "lower end" parallel processors, such as clustered workstations, are not interchangeable with vector supercomputers.[34]

We find that significant practical limitations render vector supercomputers and non-vector supercomputers not easily interchangeable for a large number of applications. We recognize that as a technical matter, virtually all codes that run on vector supercomputers can also be run on non-vector supercomputers. In practice, however, certain codes run much more efficiently and quickly on vector systems than on non-vector systems.[35] In many cases, vector supercomputers and some types of parallel processing machines perform similar analyses, and therefore may be interchangeable to some degree. However, we note that the ability of the different systems to perform similar applications is dependent upon whether comparable software has been developed for each distinct computing platform.[36] The evidence indicates that for many applications, such software has not been developed.

Two general categories of software are used in supercomputing: third-party applications and proprietary in-house applications.[37] For an application to be moved from a vector to a non-vector

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can run and, especially for proprietary software, whether the effort needed to transport the application to a non-vector supercomputer is substantial. Petitioner's Posthearing Brief at Exhibit 1. Petitioner testified that changes in technology over time may result in an older vector supercomputer being replaced by a newer alternative platform to perform the same functions. However, petitioner contends that at a given point in time, there will be a set of applications and uses that are uniquely suited to vector supercomputers. Hearing Transcript at 16-19 and 50-54.

[32] Fujitsu argues that the processing capabilities of vector and non-vector systems have converged and, thus, it has become easier for customers to switch from one architecture to another. For example, Fujitsu points out that vector and non-vector supercomputers have directly competed in a number of European weather forecasting procurements, automotive applications and seismic modeling activities. Fujitsu also argues that numerous purchasers indicated that they have switched from vector to non-vector systems. Fujitsu's Prehearing Brief at 21. NEC argues that most third-party applications run on both vector and non-vector machines. NEC's Prehearing Brief at 18-19. NEC asserts that conversion of codes has led to interchangeability of vector and non-vector architectures in sectors such as weather and climate modeling that were at one time limited to vector systems. NEC's Prehearing Brief at 22. NEC argues that the fact that there may be some applications currently running only on vector supercomputers does not support identification of a distinct like product composed of vector supercomputers. NEC's Prehearing Brief at 23.

Fujitsu also argues that the Commission should find that vector and non-vector systems are substantially interchangeable because CRI and SGI did not provide the Commission with certain competing bid information. Fujitsu argues that such information is critical to determine the extent and effect of competition between CRI and Japanese supercomputers as well as between CRI and non-vector domestic producers. Fujitsu's Prehearing Brief at 3-4. CRI and SGI did *** Further, we note that there is significant information in the record which is more probative on the issue of interchangeability than the presence of competing bids. The fact that vector and non-vector supercomputers compete for some of the same sales is not in dispute.

[33] CR at II-13, PR at II-6.

[34] CR at I-18, PR at I-11.

[35] CR at II-14-20, PR at II-6-8.

[36] CR at I-19, PR at I-11-12.

[37] According to IDC, proprietary or "in-house codes" constitute *** percent of the applications run on vector systems. CR at II-16, PR at II-7. Fujitsu disputes this number, stating that *** actually found *** Fujitsu's Comments on New Information at 7. We note, however, that either number still constitutes a *** of applications run on vector systems.

supercomputer, the software must be modified or rewritten altogether. This generally involves a significant amount of time and effort on the part of the end user or a third party. The evidence of record indicates that efforts to port (*i.e.*,move) third-party software from vector to non-vector platforms have been more successful than attempts to port proprietary software.[38] It is unclear, however, whether many third party programs are running effectively, or have been optimized on the non-vector platforms to which they have been ported. Indeed, the record indicates that several major third-party applications do not run effectively on non-vector supercomputers.[39]

Most users of proprietary, or "in-house," software indicated that their software applications were developed for a particular architecture (*i.e.*, either vector or non-vector), and that porting and optimizing large application codes to a different architecture is very difficult.[40] While some purchasers reported little trouble in doing so, many reported that porting and optimizing from a vector to a non-vector supercomputer took multiple man years, with only some reporting limited success.[41] A decision to change architectures would therefore involve a careful analysis of the cost of conversion, the cost differential of the equipment, and an analysis of the likelihood that the intended application(s) could be successfully converted.

Several types of parallel systems or features of these systems may make them a poor option for applications currently run on vector systems. For example, parallel computers with only one instruction unit and processors that work in lock-step are not good choices for most vector applications. Clustered workstations, at the low end of the distributed memory parallel processing spectrum, are not likely to perform well on very large, vector-oriented simulations, especially if the problem is time-sensitive. Applications that consist of many independent calculations, those that can be parallelized, may run more

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[38] A study prepared by respondents shows that 82 percent of the third-party applications running on Cray vector supercomputers can also be run on non-vector platforms. NEC also submitted a list of 61 third-party applications accounting for 90 percent of total supercomputer cycles using commercially available or public domain software indicating that all 61 applications are running on both vector and non-vector architectures. CR at II-14-15, PR at II-6. The study, however, does not compare the efficiency and effectiveness of running these applications on either platform. In other words, the study contains no clear indication that these ported codes have been optimized for all applications on non-vector platforms, which could have a significant effect on the actual degree of interchangeability between vector and non-vector supercomputers.

[39] CRI cited ***, as examples of widely used third-party applications that require large vector systems to run analysis reliably, in the required turnaround time, and with repeatable results. The automotive companies, *** were in general agreement that *** is generally run on large vector systems for large jobs. The responses pertaining to ***. CR at II-15-16 and n. 32-33, PR at II-7. According to an employee of the *** Staff Notes of Josh Levy, dated for release on September 19, 1997.

[40] CR at II-17, PR at II-8. According to representatives of three government agencies, it is very difficult to convert vector code to MPP code except for "embarrassingly parallel" MPP-type applications; meeting with *** Sept. 8, 1997. However, University Corporation for Atmospheric Research (UCAR) provided a letter from Dr. Hack from the National Center for Atmospheric Research (NCAR) which states that migrating NCAR's existing application codes from parallel vector architectures to non-vector SMP architectures is "a trivial exercise." CR at I-7, n. 24, PR at I-4, n.24. At the hearing, Dr. Hammond, testifying on behalf of UCAR, stated that their vector and non-vector systems were largely interchangeable. Tr. at 194. Petitioner disputes Dr. Hammond's testimony, and provided an analysis and a 1995 publication detailing problems that NCAR had encountered when it attempted to use MPP architecture. Petitioner's Posthearing Brief at Exhibit 1.

[41] For an extensive discussion of the purchaser questionnaire responses, *see* CR at II-17-20, n. 40, PR at II-8, n. 40.

efficiently on a parallel processing computer, whereas those that require serial processing usually run faster on vector supercomputers.[42]

III. Channels of Distribution

Vector and non-vector supercomputers are sold through the same or similar channels of distribution. Both are sold either by the manufacturer's direct sales force or on a competitive-bid basis for contracts announced by purchasers. The contracts are generally for entire systems, which almost always require extensive software and installation support and on-site engineering by the manufacturer for the system's operational life. Included with the system are certain spare parts to facilitate the speed of repairs, upgrades, and maintenance.[43]

IV. Common Manufacturing Facilities, Production Processes, and Production Employees

The record shows that there is some overlap in production processes, manufacturing facilities, and production employees between vector and non-vector supercomputers, but the extent of the overlap is unclear and not dispositive. We note that the petitioner views its production lines and processes for its vector and non-vector machines as "largely separate," but that there are a number of shared resources in its production of these products. [44] The petitioner reported discrete and substantial design and development costs for a vector supercomputer system, suggesting that most projects are specific to a particular family of computers. [45] [46]

In contrast, Convex, a company that ceased production of vector supercomputers in favor of non-vector systems after its acquisition by Hewlett Packard, reported in the preliminary investigation that ***.[47]

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[42] CR at I-18, PR at I-11.

[43] CR at I-21, PR at I-13.

[44] Petitioner indicated in its questionnaire response that the *** and that ***. CR at II-5, and n. 9, PR at II-3, and n. 9.

[45] Petitioner maintains substantially separate hardware and software engineering efforts for its vector and non-vector products. Petitioner asserts that the integrated circuits (ICs) used in the vector machines are custom fabricated and made separately from those used in non-vector machines, which are commodity Alpha processors, and that the largely separate assembly lines are followed by separate test facilities for "system test and check out" activities. Petitioner's Prehearing Brief at 28-29.

[46] Fujitsu argues that CRI's questionnaire response indicates that ***, and that ***. Fujitsu's Prehearing Brief at 25-26. NEC also maintains that a former supervisor confirmed that Convex manufactured vector and non-vector supercomputers at the same time on the same equipment without any significant modifications when production was shifted from one type of supercomputer to another. Additionally, NEC argues that ***, NEC's Prehearing Brief at 29, although we note that at least one respondent does not yet produce non-vector systems on a commercial basis. Transcript at 170-171.

[47] CR at II-5, PR at II-3.

V. Customer and Producer Perceptions

We find that producers and customers perceive vector and non-vector supercomputers to be distinct products.[48] [49] Vector supercomputers are purchased to run highly sophisticated programs and applications which are specifically designed for that particular architecture. This is evidenced in most purchasers' affirmative response to the question of whether software applications that they had developed in-house were usually developed for a particular architecture. While most stated that these applications could be ported to run on another architecture, many found the process to be generally very difficult, time-consuming and expensive, and often the ported code could not be run effectively on the alternate platform.[50] Therefore, the choice of a particular architecture is a commitment to that technology application for at least some period given the time, effort, and expense often involved in changing codes.

Producers also perceive a difference between vector and non-vector supercomputers. While there is competition between the producers of vector and non-vector supercomputers for customers, several producers of non-vector supercomputers in addition to CRI acknowledged that some procurements favored vector processing.[51] The fact that producers perceive the products to be different is further evidenced by the fact that both Fujitsu and NEC have added or are in the processing of adding non-vector supercomputers to complement their product line.[52] Additionally, CRI considers its vector and non-vector operations to be separate lines of business.[53] [54]

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[48] Petitioner argues that all producers of supercomputers recognize that vector supercomputers are distinct from alternative computing platforms. Petitioner asserts that non-vector manufacturers such as *** and *** both state that they did not bid for particular accounts because the specifications favored vector supercomputers. Petitioner argues that *** stated unequivocally that ***. Additionally, ***, a manufacturer of SMPs stated that ***. Petitioner argues that precisely because vector supercomputers and MPP systems compete in different segments of the high-performance computing market and meet different customer needs, Cray, NEC, Fujitsu, and Hitachi all have developed, or are developing, MPP supercomputers in addition to their vector product lines. Petitioner argues that producers view the MPPs as a complement to, and not a substitute for, vector supercomputers. Petitioner's Prehearing Brief at 24-25.

[49] Fujitsu argues that producers and customers view vector and non-vector machines as interchangeable. Fujitsu asserts that customers perceive a significant degree of interchangeability between vector and non-vector systems, with many indicating that the differences in architectures made *** in the ability of the system to handle particular sets of problems. Fujitsu's Prehearing Brief at 27. NEC argues that producers and purchasers of supercomputers do not perceive vector and non-vector supercomputers as distinct products. NEC asserts that purchasers are aware that non-vector supercomputers are nearly always substitutable for vector supercomputers and regularly consider both architectures. NEC also argues that producers, including Cray, also recognize this fact, and actively market vector and non-vector supercomputers in competition for the same customers. Similarly, NEC asserts that companies' procurement practices suggest that supercomputer purchasers perceive vector and non-vector systems as interchangeable products, and that purchasers who procured vector supercomputers during the investigative period considered non-vector supercomputers to be highly competitive with the vector systems purchased. NEC's Prehearing Brief at 34.

[50] CR at II-17-20, PR at II-8.

[51] Commission Questionnaire responses of *** and ***.

[52] Hearing Transcript at 170-71.

[53] *E.g.*, Petitioner's Prehearing Brief at 28-30.

[54] Respondents' arguments are directed primarily to the interchangeability of the different architectures, and overlook the fact that, although vector and non-vector supercomputers may be perceived to be interchangeable for

VI. Price

At the high end, vector supercomputers remain very expensive, generally ranging in price from $2.5 million to $40 million or more. At the low end, vector system prices range from $300,000 to $1 million. Scalable parallel systems range in price from $100,000 at the low end to hundreds of millions of dollars at the high end, thereby suggesting that certain non-vector systems are more expensive than vector systems.[55] Although the extent of the difference is difficult to quantify, the record indicates that, in general, non-vector systems are a less expensive option than vector machines, which supports a finding of some price distinctions between the two groups of products.[56] [57]

One important method of defining the cost of a system is to consider the costs of performance in terms of dollars per gigaflop ("Gflop"). On a cost per performance basis, prices for vector supercomputer systems ranged from ***, prices for MPPs ranged from ***, and prices for SMP/SPPs ranged from ***,[58] thereby indicating that vector supercomputers are more expensive at the high end and that there is less of an overlap in prices than if the range of total system prices were considered.

Conclusion

On the whole, the record demonstrates that physical differences between vector and non-vector supercomputers result in each type of system processing data differently. While there is some overlap in end-use applications, and some interchangeability between vector and non-vector architectures, actual interchangeability for any given application is a function of the ability to port and optimize the code from a vector to a non-vector machine. Although it is uncontested that, theoretically, many applications can be ported from one type of architecture to the other, there is considerable evidence in the record which indicates that actually doing so has mixed results and is often impractical.

Vector and non-vector supercomputers are also perceived as different products in the marketplace. Petitioner considers its vector and non-vector operations to comprise different business units, non-vector supercomputer manufacturers considered certain procurements to be vector specific, and foreign manufacturers who have historically concentrated on vector platforms are beginning to manufacture non-

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some applications, they are also perceived to be different products.

[55] CR at I-22, PR at I-14.

[56] See, e.g., Transcript at 160; CR at III-6, PR at III-4; Petitioner's Posthearing Brief at 9, which stated that 14 out of 16 questionnaire respondents considered vector systems to be more expensive.

[57] Petitioner argues that because vector and non-vector platforms are sold in a range of configurations, they are sold in a range of prices. Petitioner argues, however, that prices do not overlap in any meaningful sense, and that respondents agree that alternative platforms are systematically priced significantly below the price of vector supercomputers when the comparison is between systems of similar computing power and other features. Petitioner's Posthearing Brief at 9.

Conversely, Fujitsu argues that there is complete price overlap between vector and non-vector supercomputers. Fujitsu asserts that the responses to the Commission questionnaires indicated that the price of vector systems not subject to Buy-American requirements ***. The price of non-vector systems ***. Fujitsu's Prehearing Brief at 29-30. Similarly, NEC argues that the price overlap between vector and non-vectors is total, except perhaps at the very top of the performance scale, where very large non-vector systems tend to dominate. NEC's Prehearing Brief at 40.

[58] CR at I-23, PR at I-14.

vector supercomputers to complement their overall product lines. Similarly, purchasers reported that their software was usually written for a specific architecture.[59]

Based on the differing physical characteristics and end uses, lack of or limited interchangeability for many applications, and producer and customer perceptions, we find that there is a clear dividing line between vector supercomputers and all other supercomputers, and therefore, we define the domestic like product as vector supercomputers.

D. Domestic Industry

As noted above, section 771(4)(A) of the Act defines the relevant industry as the "producers as a whole of a domestic like product, or those producers whose collective output of the domestic like product constitutes a major proportion of the total domestic production of that product."[60] In considering the effect of the imports on the domestic industry, the Commission's practice has been to include all domestic production, whether toll-produced, captively consumed, or sold in the merchant market.[61] Based on our definition of the domestic like product, we find that the domestic industry consists of all domestic producers of vector supercomputers. [62]

II. CONDITION OF THE DOMESTIC INDUSTRY

In assessing whether a domestic industry is materially injured or threatened with material injury by reason of LTFV imports, we consider all relevant economic factors that bear on the state of the industry in the United States.[63] These factors include output, sales, inventories, capacity utilization, market share, employment, wages, productivity, profits, cash flow, return on investment, ability to raise capital, and research and development. No single factor is dispositive and all relevant factors are considered "within the context of the business cycle and conditions of competition that are distinctive to the affected industry."[64]

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[59] We seriously considered respondents' arguments for an expanded like product. However, they focus only on the mid-range portion of the non-vector market which overlaps with vector supercomputers, but fail to offer evidence of a lack of a clear dividing line between vector supercomputers and supercomputers such as lower end servers and clustered workstations. NEC's Prehearing Brief at 9-10. Clearly, clustered workstations are not like vector supercomputers, however, under respondents' proposed definition would be included in the domestic like product. High-end vector supercomputers, at least for some applications, are not generally viewed as being interchangeable with MPPs, nor are low-end MPPs, such as clustered workstations, interchangeable with even low-end vector supercomputers. CR at I-18, PR at I-11.

[60] 19 U.S.C. § 1677(4)(A).

[61] *See*, Large Newspaper Printing Presses and Components Thereof, Whether Assembled or Unassembled, from Germany and Japan, Inv. No. 731-TA-736-737(Final), USITC Pub. 2988 at 7-8 (Aug. 1996).

[62] There is currently one producer of vector supercomputers: the petitioner, CRI, Inc. Until June, 1995, Convex also produced vector supercomputers. On December 20, 1995, Convex was acquired by Hewlett-Packard, and is now a wholly owned subsidiary of HP. During 1995, Convex reduced its participation in the vector market and ***. CR at III-3-4, PR at III-2-3. Convex was ***. CR at III-1, n.1, PR at III-1, n.1.

[63] 19 U.S.C. § 1677(7)(C)(iii).

[64] *Id.*

A. Conditions of Competition

We note certain conditions of competition relevant to our analysis of the domestic vector supercomputer industry. At this time, there is a single domestic producer of vector supercomputers. The vector supercomputer market is characterized by a relatively small number of purchases in any given year.[65] These purchases, however, can involve significant expenditures, which at the high end range in price from $2.5 million to $40 million or more, and at the low end, range in price from $300,000 to $1 million.[66] At a minimum, the purchase of a vector supercomputer includes operating system software, and may also include other software, auxiliary equipment, and services. Operating system software is developed by the vector supercomputer manufacturer, and most is based on the widely used Unix operating system. Some purchases may also include some applications software developed by the hardware manufacturer. Auxiliary equipment, such as the cooling system, may also be designed and assembled by the computer hardware manufacturer. Construction design and services, on-site maintenance and repair services, and user assistance are usually included in the contract price.[67]

The largest market for supercomputers, especially the most powerful large-scale vector supercomputers is the scientific and engineering market, much of which is funded by the federal government.[68] This market accounts for one-third to one-half of the total vector supercomputer market, but has been declining and is projected to further decline in size. Some of these government sales, primarily funded by the Department of Defense and/or classified sales, are also subject to "Buy American" restrictions.[69] The value of purchases subject to "Buy American" restrictions, however, has declined overall throughout the period of investigation.[70] Similarly, sales to U.S. government agencies and commercial customers primarily serving the U.S. government represent a declining portion of the domestic market for vector supercomputers.

Because of the actual decline and projected further declines in government purchases, vector supercomputer manufacturers have sought to position themselves to increase sales to private industry, including automotive, aerospace, and energy-related firms. Currently, these industrial and commercial customers account for roughly 30 percent of the supercomputer market.[71] The growth in the industrial customer base, and change in producer market focus has, at least in part, contributed to a shift in customer demand from large scale to mid-range vector supercomputer systems, which in turn yields smaller profit margins to the domestic manufacturer.[72] At the same time, the vector supercomputer industry is facing

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[65] Table IV-2, CR at IV-5, PR at IV-2.

[66] CR at I-22, PR at I-14.

[67] CR at I-9, PR at I-6.

[68] CR at II-1, PR at II-1.

[69] CR at II-3, PR at I-1.

[70] CR at II-3, PR at II-1. The contract value of CRI's U.S. sales and/or leases subject to "Buy American" restrictions declined from ***. These accounted for ***. CR at II-3, PR at II-1-2.

[71] CR at II-1, PR at II-1.

[72] CR at VI-1-3, PR at VI-1.

increasing competition for mid-range applications from non-vector supercomputers such as MPPs and SMPs because of enormous improvements in computing capabilities of commodity processors.[73] [74]

Development of a new generation of vector supercomputers entails large capital expenditures.[75] As such, failure of the domestic industry to obtain an adequate rate of return on any given generation of product severely handicaps its ability to fund the next generation product.

Because the number and value of sales tend to fluctuate from year to year, changes in industry performance on a year-to-year basis may be of limited utility; thus, we have viewed data concerning trends over the period of investigation with caution.

B. Condition of the Industry

U.S. capacity to produce vector supercomputer systems increased from 1994 to 1995, and then declined in 1996 almost to the level in 1994. Capacity, when measured by gigaflops, increased from 1994 to 1996. Capacity was lower in interim (January-June) 1997 compared with interim 1996, when measured by systems or gigaflops.[76] Production of vector supercomputers, when measured in terms of systems and gigaflops, increased from 1994 to 1995, and then declined in 1996. Production of systems was lower in interim 1997 compared with interim 1996, and production, when measured in terms of gigaflops was higher in interim 1997 compared with interim 1996.[77] Capacity utilization was low throughout the period and followed the same general trends as capacity and production.[78]

Domestic consumption of vector supercomputers, when measured in number of systems, increased from 1994 to 1995, and then declined in 1996. The number of systems consumed was lower in interim 1997 compared with interim 1996.[79] The value of domestic consumption, however, followed different

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[73] CR at III-6, PR at III-4.

[74] *See*, Iwatsu Elec. Co., Ltd. v. U.S., 758 F. Supp. 1506, 1518 (Ct. Int'l. Trade 1994) (importers take the domestic industry as they find it.)

[75] CRI indicated that the design and development of a vector supercomputer requires $75 million per year or more in expenditures for hardware and software research and development. Petitioner's Prehearing Brief at 28.

[76] CR at III-8, PR at III-5. Capacity, when measured in number of systems increased from *** systems in 1994 to *** systems in 1995, and then declined to *** systems in 1996. Capacity was *** systems in interim 1997 compared with *** systems in interim 1996. Capacity, when measured in gigaflops, increased from *** gigaflops in 1994 to *** gigaflops in 1995, and then increased to *** gigaflops in 1996. Capacity was *** in interim 1997 compared with *** gigaflops in interim 1996. Table III-1; CR at III-10, PR at III-6 .

[77] CR at III-8, PR at III-5. Production, when measured by number of systems, increased from *** systems in 1994 to *** systems in 1995, and then declined to *** systems in 1996. *** systems were produced in interim 1997 compared with *** systems in interim 1996. Production, when measured by gigaflops, increased from *** gigaflops in 1994 to *** gigaflops in 1995, and then declined to *** gigaflops in 1996. Production was *** gigaflops in interim 1997 compared with *** gigaflops in interim 1996. Table III-1; CR at III-10, PR at III-6.

[78] Capacity utilization, when measured by number of systems, increased from *** percent in 1994 to *** percent in 1995, and then declined to *** percent in 1996. Capacity utilization was *** percent in interim 1997 compared with *** percent in interim 1996. Capacity utilization, when measured in gigaflops, declined from *** percent in 1994 to *** in 1995, and further declined to *** percent in 1996. Capacity utilization was *** percent in interim 1997 compared with *** percent in interim 1996. Table III-1; CR at III-10, PR at III-6.

[79] Table IV-2; CR at IV-5, PR at IV-2. Apparent consumption, when based on number of systems increased from *** systems in 1994 to *** systems in 1995, and then declined to *** systems in 1996. *** systems were consumed in interim 1997 compared with *** systems in interim 1996. Domestic consumption, when measured in

trends, declining significantly from 1994 to 1995, and then increasing in 1996 to levels below that in 1994. The value of domestic consumption was higher in interim 1997 compared with 1996.[80]

The volume of total U.S. shipments of systems increased between 1994 and 1995, and then decreased in 1996. The volume of total U.S. shipments of systems was lower in interim 1997 compared with interim 1996.[81] The value of U.S. shipments of systems, however, declined between 1994 and 1995, and then increased in 1996, although to a level lower than that in 1994.[82] Inventories declined throughout the period of investigation. Inventory levels were relatively high throughout the period, reflecting at least in part the fact that CRI restructured its product line in 1995 to tap demand for new applications. The ratio of inventories to U.S. shipments was *** percent in 1994 and declined to *** percent in 1996, although the ratio of inventories to shipments reached *** in January-June 1996. This ratio fell to *** percent in the corresponding period of 1997.[83]

The number of production and related workers producing vector supercomputers declined throughout the period of investigation. Wages paid to these workers declined from 1994 to 1995, and then increased in 1996, to a lower level than in 1994. Wages paid were higher in interim 1997 compared with interim 1996.[84]

The domestic industry's financial performance was poor throughout the period of investigation. The domestic industry experienced a dramatic drop in revenues from 1994 to 1995 followed by a smaller

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gigaflops, increased throughout the period of investigation, increasing from *** gigaflops in 1994 to *** gigaflops in 1995, and then increasing to *** gigaflops in 1996. Domestic consumption was *** gigaflops in interim 1997 compared with *** gigaflops in interim 1996. *Id.*

[80] Table IV-2, CR at IV-5, PR at IV-2. The value of domestic consumption declined from *** in 1994 to *** in 1995, and then increased to *** in 1996. The value of domestic consumption was *** in interim 1997 compared with *** in interim 1996. The value of domestic consumption in terms of gigaflops declined from *** in 1994 to *** in 1995, and increased to *** in 1996. The value of domestic consumption in terms of gigaflops was *** in interim 1997 compared with *** in interim 1996. *Id.*

[81] CR at III-8, PR at VI-5. The volume of total U.S. shipments of systems increased from *** systems in 1994 to *** systems in 1995, and declined to *** systems in 1996. There were *** U.S. shipments of systems in interim 1997 compared with *** systems in interim 1996. Table III-2; CR at III-11, PR at III-6. The volume of total U.S. shipments in terms of gigaflops increased from *** gigaflops in 1994 to *** gigaflops in 1995, and further increased to *** gigaflops in 1996. There were *** gigaflops shipped in interim 1997 compared with *** gigaflops in interim 1996. Table III-3, PR at III-12, CR at III-6.

[82] CR at III-8, PR at III-5. U.S. shipments, in terms of systems and gigaflops declined in value from *** in 1994 to *** in 1995, and then increased to *** in 1996. U.S. shipments were *** in interim 1997 compared with *** in interim 1996. Table III-2-3, CR at III-11-12, PR at III-6.

[83] CR at III-8-9, PR at III-5. Inventories of systems declined from *** systems in 1994 to *** systems in 1995, and further declined to *** systems in 1996. There were *** systems inventoried in interim 1997 compared with *** systems in interim 1996. The ratio of inventories to production declined from *** percent in 1994 to *** percent in 1995, and then increased to *** percent in 1996. The ratio of inventories to production was *** percent in interim 1997 compared with *** percent in interim 1996. The ratio of inventories to U.S. shipments declined from *** percent in 1994 to *** percent in 1995, and then increased to *** percent in 1996. The ratio of inventories to U.S. shipments was *** percent in interim 1997 compared with *** percent in interim 1996. Inventories in terms of gigaflops followed the same general trends. Table III-4; CR at III-13, PR at III-6.

[84] The number of production and related workers declined from *** in 1994 to *** workers in 1995, and further declined to *** workers in 1996. The number of workers in interim 1997 was *** compared with *** in interim 1996. Hourly wages declined from *** in 1994 to *** in 1995, and then increased to *** in 1996. Hourly wages were *** in interim 1997 compared with *** in interim 1996. Table III-5; CR at III-14, PR at III-7.

decrease in 1996 revenue. Total revenue was higher in interim 1997 compared with interim 1996.[85] The domestic industry reported *** throughout much of the period, with the *** on vector supercomputers since 1994 reported in interim 1997. Operating income as a ratio to net sales followed the same trends.[86] Capital expenditures generally declined throughout the period of investigation, but were higher in interim 1997 compared with interim 1996.[87] Research and development expenditures also declined throughout the period, and were lower in interim 1997 compared with interim 1996.[88] [89]

III. NO MATERIAL INJURY BY REASON OF LTFV IMPORTS OF VECTOR SUPERCOMPUTERS[90]

In the final phase of an antidumping investigation, the Commission determines whether an industry in the United States is materially injured by reason of the imports under investigation.[91] In making this determination, the Commission must consider the volume of imports, their effect on prices for the domestic like product, and their impact on domestic producers of the domestic like product, but only in the context of U.S. production operations.[92] Although the Commission may consider causes of injury to the industry

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[85] Total revenue declined from *** in 1994 to *** in 1995, and further declined to *** in 1996. Total revenue was *** in interim 1997 compared with *** in interim 1996. Table VI-1, CR at VI-2, PR at VI-2.

[86] Operating income declined from *** in 1994 to an *** of *** in 1995, and then improved to a *** of *** in 1996. Operating income in interim 1997 was *** compared with a *** of *** in interim 1996. Operating income as a ratio to net sales was *** percent in 1994, a *** of *** percent in 1995, and a *** of *** percent in 1996. Operating income as a ratio to net sales was *** percent in interim 1997 compared with a *** of *** percent in interim 1996. Table VI-1, CR at VI-2, PR at VI-2. The decline in operating income and operating margins would have been even greater in the latter part of the period of investigation had it not been for the ability of the petitioner to export a significant percentage of its production of vector supercomputers. Operating income on the U.S. market declined from *** in 1994 to a *** of *** in 1995, and then *** to a *** of *** in 1996. Operating *** were *** in interim 1997 compared with *** of *** in interim 1996. Operating income as a ratio of net sales in the U.S. market was *** percent in 1994, a *** of *** percent in 1995, and a *** of *** percent in 1996. Operating income as a ratio of net sales was a *** of *** percent in interim 1997 compared with a *** percent in interim 1996. Table VI-2, CR at VI-6, PR at VI-2.

[87] Capital expenditures declined from *** in 1994 to *** in 1995, and further declined to *** in 1996. Capital expenditures were *** in interim 1997 compared with *** in interim 1996. Table VI-3, CR at VI-7, PR at VI-3.

[88] Research and development expenditures declined from *** in 1994 to *** in 1995, and further declined to *** in 1996. Research and development expenditures were *** in interim 1997 compared with *** in interim 1996. Table VI-3, PR at VI-7, CR at VI-3.

[89] Based on the foregoing, Commissioner Newquist finds that the domestic industry producing vector supercomputers is vulnerable to the continuing adverse effects of LTFV imports. Commissioner Newquist thus proceeds directly to the "threat of material injury" discussion.

[90] Commissioner Newquist does not join in this section of the opinion.

[91] 19 U.S.C. § 1673b(a). The statute defines "material injury" as "harm which is not inconsequential, immaterial, or unimportant." 19 U.S.C. § 1677(7)(A).

[92] 19 U.S.C. § 1677(7)(B)(I). The Commission "may consider such other economic factors as are relevant to the determination," but shall "identify each [such] factor . . . and explain in full its relevance to the determination." 19 U.S.C. § 1677(7)(B).

other than the LTFV imports,[93] it is not to weigh causes.[94] For the reasons discussed below, we find that the domestic industry producing vector supercomputers is not materially injured by reason of LTFV imports from Japan.

A. Volume of Subject Imports

The volume of subject imports was relatively small in 1994 and 1995, but increased significantly in 1996 and interim 1997, both absolutely and relative to domestic consumption. Although there was *** subject import shipment of supercomputer systems in each of ***, the number of imported systems shipped increased to *** in 1996. *** subject import systems were shipped in interim (January-June) 1997 compared with *** systems shipped in interim 1996.[95] Based on the number of systems, these shipments of imports accounted for *** percent of apparent domestic consumption in 1994, *** percent in 1995, and *** percent in 1996. Subject import systems accounted for *** percent of apparent domestic consumption of systems in 1997 compared with *** in interim 1996.[96]

The value of subject import shipments increased from *** in 1994 to *** in 1995, and further increased to *** in 1996. The value of subject import shipments was *** in interim 1997 compared with *** in 1996.[97] As a share of the value of domestic consumption, shipments of systems accounted for *** percent in 1994, *** percent in 1995, and *** percent in 1996. The value of subject import shipments accounted for *** percent of domestic consumption in interim 1997 compared with *** percent in interim 1996.[98]

In terms of the number of gigaflops, subject import shipments declined from *** gigaflops in 1994 to *** gigaflops in 1995, and then increased to *** gigaflops in 1996. *** gigaflops were shipped in interim 1997 compared with *** gigaflops in interim 1996.[99] Based on the number of gigaflops, these imports accounted for *** percent of domestic consumption in 1994, *** percent in 1995, and *** percent in 1996. Subject import shipments accounted for *** percent of domestic consumption of gigaflops in interim 1997 compared with *** percent in interim 1996.[100]

The value of subject import shipments, based on gigaflops, declined from *** in 1994 to *** in 1995, and then increased to *** in 1996. The value of subject import shipments, based on gigaflops, was

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[93] Alternative causes may include the following:

> [T]he volume and prices of imports sold at fair value, contraction in demand or changes in patterns of consumption, trade, restrictive practices of and competition between the foreign and domestic producers, developments in technology, and the export performance and productivity of the domestic industry.

S. Rep. No. 249, 96th Cong., 1st Sess. 74 (1979). Similar language is contained in the House CR. H.R. Rep. No. 317, 96th Cong., 1st Sess. 46-47 (1979).

[94] See, e.g. Gerald Metals, 937 F. Supp. 930, 936 (Ct. Int'l Trade 1996), Citrosuco Paulista, S.A. v. United States, 704 F. Supp. 1075, 1101 (Ct. Int'l Trade 1988).

[95] Table IV-2; CR at IV-5, PR at IV-2.

[96] Table IV-3, CR at IV-6, PR at IV-2.

[97] Table IV-2, CR at IV-5, PR at IV-2.

[98] Table IV-3, CR at IV-6, PR at IV-2.

[99] Table IV-2, CR at IV-5, PR at IV-2.

[100] Table IV-3, CR at IV-6, PR at IV-2.

*** in interim 1997 compared with *** in interim 1996.[101] As a share of the value of domestic consumption based on gigaflops, subject import shipments accounted for *** percent in 1994, *** percent in 1995, and *** percent in 1996. The value of subject import shipments based on gigaflops accounted for *** percent of the value of domestic consumption in interim 1997 compared with *** percent in interim 1996.[102]

We find that there has been a significant increase in the volume of subject imports during the latter part of the period of investigation. There were a total of *** systems shipped during the period of investigation. These systems accounted for a significant and increasing percentage of domestic consumption during the latter part of the period of investigation, whether viewed in terms of systems, value of systems, or number of gigaflops.[103] We find the increase in volume and market share of subject imports, both in terms of quantity (systems and gigaflops) and value, to be significant.

B. Price

Our pricing analysis is complicated by the differing specifications for any given procurement of a vector supercomputer and the differences in the quantity and size of vector supercomputers purchased. Thus, price comparisons for different procurements is difficult, as is an analysis of price effects over time.[104] However, based on the record of this investigation, we cannot conclude that the LTFV imports significantly affected domestic prices during the period of investigation.[105]

Most vector supercomputers are sold through a closed-bid procedure or are sole-sourced. The bid procedure typically includes a formal request for proposal (RFP) which contains detailed specifications for the system(s) to be delivered, a delivery schedule, proposed terms and conditions, financial requirements, and proposal/bid-evaluation criteria.[106] After the initial bid submissions, purchasers begin negotiations with the suppliers who have been deemed to be within the competitive range of offers. This process can take several months as purchasers try to decide which package offers the best value on the basis of performance, price, reputation, and service-related aspects.[107]

The Commission received domestic and subject import bid information where the domestic and imported product were in direct competition on ***.[108] We note that the parties' arguments initially focused

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[101] Table IV-2, CR at IV-5, PR at IV-2.

[102] Table IV-3, CR at IV-6, PR at IV-2.

[103] Respondents argue that the import volume figures are misleading because a portion of the imports are imported for use ***. Fujitsu's Prehearing Brief at 48-49. While we have taken this into account in assessing the significance of these imports, we note that the value of subject imports may actually be understated because *** were valued ***. ***. Also, it is unclear from the record whether these systems may have displaced potential U.S. sales, or whether these systems may ultimately be sold or leased in the marketplace. We note that ***. Verification Report at 4.

[104] Respondents assert that a measurement of $/Gflop is not a reliable measurement of price, Fujitsu's Posthearing Brief at 5, but do not proffer an alternative method for the Commission to assess the effects on domestic prices as required by the statute. Given the differences between various systems in a given procurement, the best information available in the record on the issue of price is an assessment of the price/performance ratio.

[105] CR at V-5-26, PR at V-3-6.

[106] CR at V-2-3, PR at V-2-3.

[107] CR at V-3, PR at V-3.

[108] CR at V-26-27, PR at V-6.

primarily on one transaction--the possible sale by NEC of four supercomputer systems to Federal Computer Corporation ("FCC"), an independent party that was to lease the supercomputers, together with U.S.-sourced peripheral equipment and services, to the University Corporation for Atmospheric Research ("UCAR") for use by the National Center for Atmospheric Research ("NCAR"). On May 20, 1996, UCAR announced its intention to enter into final contract negotiations with FCC for NEC machines. However, on August 29, 1997, Dr. Neil Lane, Director of the National Science Foundation announced, in response to the Department of Commerce's final antidumping determination, that it would not fund the UCAR procurement from NEC.[109] This bid was the first indication of the Japanese producers' ability to and interest in, competing in the U.S. market for large scale vector supercomputer systems. Moreover, the FCC bid provided considerably more computing capability within the purchaser's budget constraint than the CRI bid.

The Commission also received competing CRI and Japanese bid information concerning ***. Based on the sales completed during the period of investigation where the imported and domestic product engaged in head-to-head competition, we note that while price was an important consideration, these contracts appear to have been ultimately awarded on a basis other than price.[110] There were a limited number of sales and based on those sales we cannot conclude that there have been significant adverse price effects. However, as discussed in more detail below in our analysis of threat of material injury, we find that the evidence of underbidding on both a price and a performance basis, coupled with the increasing number of transactions for which the subject imports are competing, will likely result in significant suppressive and depressive price effects in the future.[111]

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[109] CR at VII-6, n. 23, PR at VII-3, n. 23.

[110] After the initial bid submissions, purchasers begin negotiations with the suppliers who have been deemed to be *within the competitive range of offers.* (emphasis added). CR at V-3, PR at V-3.

[111] In this regard, we note that there is at least one sale *** where the domestic producer had to lower its price in order to meet the imported price. CR at V-31-32, PR at V-6. Further, there is evidence in the record that NEC offered *** at the same price as the domestic producer in the fixed-price UCAR transaction.

C. Impact[112] [113] [114]

In the final phase of this investigation, we do not find that subject imports have yet had a significant adverse impact on the domestic industry. While the domestic industry has not performed well financially during the period of investigation, we find that the domestic industry experienced its poorest financial and operating performance in 1995 when the market penetration of subject imports was at or near a low point for the investigative period in terms of both systems and Gflops. CRI itself explained that the lower gross profit margins in 1995 compared to 1994 are a result of several factors: (1) a shift in the product mix to small, lower-value, and lower-margin systems, (2) a decrease in sales on its high-end products, resulting primarily from this product transition, and (3) proportionally increased service revenues, which have lower gross margins than product revenues.[115] CRI has a large customer base in government agencies and companies that ***. CRI itself acknowledged that its total revenue from U.S. government agencies or commercial customers primarily serving the U.S. government declined approximately $224 million between 1994 and 1995.[116] This post Cold-War decline in government spending on vector supercomputers has caused CRI to focus its efforts on the commercial market, which generally purchases smaller, lower-margin systems. These market conditions at least in part caused CRI to undergo a major restructuring of its operations, which had an adverse effect on its operating income from 1995 onward.[117] While this restructuring resulted from market conditions unrelated to imports, we find that restructuring has made the industry more vulnerable to the effects of imports.

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[112] The statute specifies that the Commission is to consider "the magnitude of the margin of dumping" in its evaluation of the impact of imports on the domestic industry. 19 U.S.C. § 1677(7)(C)(iii)(V); *see also* 19 U.S.C. § 1677(35)(C); URAA Statement of Administrative Action ("SAA"), H.R. Rep. 316, 103d Cong., 2d Sess., vol. I at 850 (this provision "does not alter the requirement in current law that none of the factors which the Commission considers is necessarily dispositive of the Commission's material injury analysis"). The statute further states that the dumping margins that the Commission is to consider in making a final determination are those "most recently published by the administering authority prior to the closing of the Commission's administrative record." 19 U.S.C. § 1677(35)(C)(ii). The final antidumping margins found by the Department of Commerce are 173.08 percent for Fujitsu, 454.00 percent for NEC, and 313.54 percent for all other Japanese exporters/manufacturers. 62 Fed. Reg. 45623 (August 28, 1997).

[113] Chairman Miller notes that the extremely high margins of dumping issued by the Department of Commerce in this case suggest very aggressive pricing practices by respondents. Chairman Miller finds that unfair pricing of this magnitude is likely to result in material injury to the domestic industry. Accordingly, this factor, while not decisive in and of itself, supports an affirmative determination that the domestic industry is threatened with material injury.

[114] Vice Chairman Bragg notes that she does not ordinarily consider the margin of dumping to be of particular significance in evaluating the effects of subject imports on domestic producers. *See* Separate and Dissenting Views of Commissioner Lynn M. Bragg in Bicycles from China, Inv. No. 731-TA-731 (Final), USITC Pub. 2968 (June 1996).

[115] CR at VI-1-3, PR at VI-1.

[116] CR at VI-3, PR at VI-2.

[117] CR at VI-2-4, PR at VI-2.

V. THREAT OF MATERIAL INJURY BY REASON OF LTFV IMPORTS [118]

Section 771(7)(F) of the Act directs the Commission to consider whether the U.S. industry is threatened with material injury by reason of the subject imports by taking into account whether "further dumped or subsidized imports are imminent and whether material injury by reason of imports would occur unless an order is issued or a suspension agreement is accepted."[119] The Commission may not make such a determination "on the basis of mere conjecture or supposition,"[120] and considers the threat factors "as a whole."[121] In making our determination, we have considered all statutory factors[122] that are relevant to this investigation.[123]

For the reasons discussed below, we find that the domestic industry producing vector supercomputers is threatened with material injury by reason of the LTFV imports from Japan.

Japanese producers' capacity increased overall throughout the period of investigation, and is expected to increase in the future.[124] Capacity utilization increased throughout the period, but was lower in interim 1997 compared with interim 1996.[125] Additionally, capacity utilization is projected to decline from *** percent for full year 1996 to *** percent in 1997, and then increase to *** percent in 1998.[126] However, in an industry characterized by a limited number of high-value, custom-configured sales (or

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[118] Commissioner Newquist notes that, in his analytical framework, "evaluation of the magnitude of the margin of dumping" is not generally helpful in answering the questions posed by the statute: whether the domestic industry is threatened with material injury; and, if so, whether such threat of injury is by reason of the subject imports.

[119] 19 U.S.C. § 1673b(a) and 1677(7)(F)(ii).

[120] 19 U.S.C. §1677(7)(F)(ii). An affirmative threat determination must be based upon "positive evidence tending to show an intention to increase the levels of importation." Metallverken Nederland B.V. v. United States, 744 F. Supp. 281, 287 (Ct. Int'l Trade 1990), *citing* American Spring Wire Corp. v. United States, 590 F. Supp. 1273, 1280 (Ct. Int'l Trade 1984). *See also* Calabrian Corp. v. United States, 794 F. Supp. 377, 387 & 388 (Ct. Int'l Trade 1992), *citing* H.R. Rep. No. 1156, 98th Cong., 2d Sess. 174 (1984).

[121] While the language referring to imports being imminent (instead of "actual injury" being imminent and the threat being "real") is a change from the prior provision, the SAA indicates the "new language is fully consistent with the Commission's practice, the existing statutory language, and judicial precedent interpreting the statute." SAA at 184.

[122] The statutory factors have been amended to track more closely the language concerning threat of material injury determinations in the Antidumping and Subsidies Agreements, although "[n]o substantive change in Commission threat analysis is required." SAA at 185.

[123] 19 U.S.C. § 1677(7)(F)(I). Factor I regarding consideration of the nature of the subsidies alleged is inapplicable because there have not been any subsidies alleged. Factor VII regarding raw and processed agriculture products is also inapplicable to the *products* at issue. *See* 19 U.S.C. § 1677(7)(F)(iii)(I).

[124] Japanese producers' capacity to produce vector supercomputers increased from *** systems in 1995 to *** in 1996, and then increased to *** systems in 1996. Capacity in interim 1997 was *** systems compared with *** systems in interim 1996. Capacity is projected to increase to *** systems in 1997 and further increase to *** systems in 1998. Table VII-1, CR at VII-7, PR at VII-4. Capacity in terms of gigaflops followed the same general trends. Table VII-2, CR at VII-8, PR at VII-4.

[125] Capacity utilization, when measured in systems, increased from *** percent in 1994, to *** percent in 1995, and further increased to *** percent in 1996. Capacity utilization was *** percent in interim 1997 compared with *** percent in interim 1996. Table VII-1, CR at VII-7, PR at VII-4. Capacity utilization in terms of gigaflops followed the same general trends. Table VII-2, CR at VII-8, PR at VII-4.

[126] Table VII-1, CR at VII-7, PR at VII-4.

leases), capacity appears to be determined primarily by sales volumes rather than production constraints or ceilings.[127] We find, therefore, that there is available capacity in the exporting country to increase exports to the United States.

Although respondents argue that the Japanese producers focus on their home market and export markets other than the United States, the record indicates that as a percentage of total shipments of systems, home market shipments have declined throughout the period of investigation, and exports to all other markets also declined from 1995 to 1996.[128] At the same time, exports to the United States increased as a percentage of total shipments of systems.[129]

We also find that there has been a significant rate of increase in the volume and market penetration of imports of LTFV vector supercomputers, indicating the likelihood of substantially increased imports.[130] The quantity of subject import shipments, both in terms of number of systems and total gigaflops increased overall during the period of investigation. The value of import shipments increased in all but the interim

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[127] CR at VII-4, PR at VII-2.

[128] As a percentage of total shipments of systems, home market shipments declined from *** percent in 1994 to *** percent in 1995, and further declined to *** percent in 1996. Home market shipments were *** percent in interim 1997 compared with *** percent in interim 1996. Exports to all other markets as a share of total shipments of systems increased from *** percent in 1994 to *** percent in 1995, and declined to *** percent in 1996. Exports to all other markets were *** percent in interim 1997 compared with *** percent in interim 1996. Table VII-1, CR at VII-7, PR at VII-2. As a percentage of total shipments, in terms of gigaflops, home market shipments declined from *** percent in 1994 to *** percent in 1995, and further declined to *** percent in 1996. As a percentage of total shipments of gigaflops, home market shipments were *** percent in interim 1997 compared with *** percent in interim 1996. Exports to all other markets as a percentage of total shipments of gigaflops, increased from *** percent in 1994 to *** percent in 1995, and further increased to *** percent in 1996. Exports to all other markets as a percentage of total shipments of gigaflops were *** percent in interim 1997 compared with *** percent in interim 1996. Table VII-2, CR at VII-8, PR at VII-4.

[129] As a percentage of total shipments of systems, exports to the United States increased from *** percent in 1994 to *** percent in 1995, and further increased to *** percent in 1996. Exports to the United States were *** percent of total shipments of systems in interim 1997 compared with *** percent of total shipments of systems in interim 1996. Table VII-1, CR at VII-7, PR at VII-4. As a percentage of total shipments, measured in gigaflops, exports to the United States declined slightly from *** percent in 1994 to *** percent in 1995, and then increased to *** percent in 1996. Exports to the United States, when measured in gigaflops, were *** percent in interim 1997 compared with *** percent in interim 1996. Table VII-2, CR at VII-8, PR at VII-4.

[130] This is further supported by statements that Fujitsu and NEC made in the Japanese press in July 1996 indicating that they hoped to expand sales volumes by 100 percent and 63 percent (by number of orders), respectively, in fiscal year 1996 compared to fiscal year 1995. Other Japanese press reports have cited Fujitsu and NEC as hoping to increase exports to the United States and Europe of less expensive complementary metal oxide semiconductor ("CMOS") processor-based vector supercomputers. CR at VII-4, PR at VII-3.

periods.[131] In terms of quantity and value, subject import market share followed the same trends.[132] We find that the large increases in subject import volume and market share during the latter part of the period of investigation, coupled with the fact that there were a significant number of potential sales that were either canceled or postponed because of the pendency of this investigation, indicate the imminent likelihood of substantially increased imports.[133]

NEC acknowledged that it had solicited sales of vector supercomputers, and was close to success in at least three industrial or commercial sales and a sale to a government entity. According to NEC's own affidavits, these potential sales were thwarted due to the pendency of this investigation.[134] NEC argues that these transactions were "small."[135] In our view, however, regardless of their size, these transactions demonstrate the ability of the respondents to make significant inroads into the critical U.S. industrial and commercial markets, and also indicate the growing acceptance of these systems by several of the domestic

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[131] *** Japanese import shipment of vector supercomputers was reported for 1994, *** shipments were reported for 1995, and *** shipments were reported for 1995. There were *** shipments of subject imports in interim 1997 compared with *** shipments in interim 1996. In terms of gigaflops, import shipments declined from *** gigaflops in 1994 to *** gigaflops in 1995, and then increased to *** gigaflops in 1996. *** gigaflops were shipped in interim 1997 compared with *** gigaflops in interim 1996. The value of subject import system shipments increased from *** in 1994 to *** in 1995, and *** to *** in 1996. The value of subject import system shipments was *** in interim 1997 compared with *** in interim 1996. Table IV-2; CR at IV-5, PR at IV-2. The value of gigaflop shipments declined from *** in 1994 to *** and then increased to *** in 1996. The value of gigaflops shipped in interim 1997 was *** compared with *** in interim 1996. *Id.*

[132] In terms of quantity of systems, subject import market share declined from *** percent in 1994 to *** percent in 1995, and then increased to *** percent in 1996. Import market share, based on the number of systems, was *** percent in interim 1997 compared with *** percent in interim 1996. In terms of value of systems, subject import market share increased from *** percent in 1994 to *** percent in 1995, and further increased to *** percent in 1996. Subject import market share, as measured by value of systems, was *** percent in interim 1997 compared with *** percent in interim 1996. In terms of the quantity of gigaflops, subject import market share declined from *** percent in 1994 to *** percent in 1995, and then increased to *** percent in 1996. Subject import market share, based on gigaflops, was *** percent in interim 1997 compared with *** percent in interim 1996. Subject import market share, as measured by value of gigaflops, increased from *** percent in 1994 to *** percent in 1995, and then increased to *** percent in 1996. Subject import market share, as measured by value of gigaflops, was *** percent in interim 1997 compared with *** percent in interim 1996. Table IV-3, CR at IV-6, PR at IV-2.

[133] Respondents assert that some imported systems were for internal use. It is unclear, however, whether any of these "internal use" machines may be sold or leased on the open market in the future. In this regard, we note that ***. Verification Report at 4. Additionally, our finding of the likelihood of increased sales in the future is based on evidence of potential open market sales.

[134] These statements were made in affidavits submitted to the Court of International Trade in litigation related to Commerce's antidumping proceeding. These affidavits are reproduced at Exhibits E and F of Petitioner's Prehearing Brief. NEC does not dispute that these sales were being solicited. They identify the customers as ***. Although NEC asserts that only *** of these contracts was described as imminent, NEC's Posthearing Brief at 12-13, the fact that active solicitation and apparent offers for sale were taking place at a number of accounts, taken together with the rapid increase in imports, supports the conclusion that imports are likely to increase in the future. NEC itself acknowledges in the affidavits that it was at least "well positioned" or "progressing" at a number of these accounts. *See* Affidavits at Exhibits E and F of Petitioner's Prehearing Brief.

[135] NEC's Posthearing Brief at 12-13. NEC argues that these transactions were small transactions and valued at only between *** for *** and ***. *Id.*

industry's larger, traditional customers.[136] The record also indicates that *** was the sole bidder in pending bids to ***,[137] and ***.[138] Moreover, the record indicates *** involving ***. *** of these was valued at ***.[139] Based on the reported value of the bids, at least *** potential transactions appear to be in addition to those reported to the CIT.[140] Moreover, the domestic industry restructuring has caused it to focus on industrial and other commercial purchasers, which traditionally purchase smaller vector supercomputers. Because of the current actual and projected decline in government procurements, sales to the industrial and other commercial market are increasingly important to the domestic industry. The inroads by subject imports into this market are significant in our analysis of threat of material injury. Moreover, we find that NEC's initial success in the UCAR procurement indicates that Japanese producers are also making inroads into the market for larger, higher value vector supercomputers[141] which offer the highest profit margins. [142]

We also find that the increased subject imports will enter at prices likely to depress or suppress domestic prices to a significant degree. The Commission received competing domestic and imported bid information concerning 5 projects *** including bid information relating to the canceled UCAR transaction. In three out of the five instances, the imported product significantly underbid the domestic product. Although the foreign producer was often not successful with the low bid, this aggressive pricing behavior is an indication of the willingness of the Japanese producers to price aggressively to try to take sales from the domestic industry.

In a bid to ***. Similarly, ***.[143] Finally, FCC's bid on the canceled UCAR project, for which it was the only company still under consideration, was *** than the competing domestic bid, based on $million/Gflop.[144] Although the domestic industry ultimately won the sale in three of those instances,[145] FCC's success in the UCAR transaction demonstrates that the strategy of underbidding (in terms of $million/Gflop) enables the producers of the subject imports to make inroads into the domestic market through the use of a substantially lower price when measured in terms of $million/Gflop. Moreover, as demonstrated in the fixed-price UCAR transaction, subject foreign producers are offering ***. We have considered the arguments regarding the failure on the part of petitioner to meet certain of UCAR's

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[136] We note also that compatibility with existing equipment may lead to follow-up sales. CR at V-4, PR at V-3.

[137] Table V-1, CR at V-7, PR at V-2. The specifications on this system are *** gigaflops. Table V-2, CR at V-10, PR at V-2.

[138] Table V-5, CR at V-16, PR at V-2. The peak performance was *** gigaflops. Table V-6, CR at V-19, PR at V-2.

[139] Table V-1, CR at V-7, PR at V-2, Table V-5, CR at V-16, PR at V-2. The peak performance of the first system was *** gigaflops, and the second was *** gigaflops. Table V-2, CR at V-10, PR at V-2, Table V-6, CR at V-19, PR at V-2.

[140] The values reported to the Commission of the pending or canceled *** bid and at least one of the *** bids are well above the *** range that NEC valued the transactions described in the CIT affidavits. Therefore, these appear to be additional transactions. However, we note that even if these reported sales are the same potential transactions referred to in the CIT affidavits, we find that the record supports our conclusion that imports are likely to increase in the future.

[141] As indicated above, *** is the sole bidder reported in a pending large sale to *** valued at ***. Table V-1, CR at V-7, PR at V-2.

[142] CR at VI-3, PR at VI-1.

[143] CR at V-26, PR at V-6.

[144] CR at V-26, PR at V-6.

[145] CR at V-26-27, PR at V-6.

requirements, but note that the domestic producer was considered sufficiently qualified to be invited to the final negotiations in the UCAR bidding process. In addition, we note that when asked what it would have done had the imported product been excluded from the bidding process, Dr. Buzbee, Director, NCAR Supercomputing Division, stated that UCAR would have chosen the domestic vector supercomputer producer's 3-year $13.25 million proposal, and then gone to the marketplace for additional equipment.[146]

Furthermore, in at least one instance, the *** by a Japanese producer caused the domestic producer to lower its price.[147] Although purchasing decisions are made on the basis of a variety of factors, price clearly is one of these, and the underbidding by the Japanese producers, coupled with the increasing marketing activity by these producers, indicates that the imports will likely have a significant price depressing or suppressing effect on domestic prices. The industry's current weakened financial condition makes it particularly vulnerable to such future adverse price effects from the dumped imports.

Inventories of the subject merchandise are not a factor in this investigation because the Japanese producers reported that inventories are ***.[148]

Japanese producers reported that they ***. Specifically, ***.[149] Similarly, ***.[150] However, as respondents acknowledged, the primary reason that product shifting is not an issue in this investigation is because of the excess capacity to produce vector supercomputers in Japan, thereby enabling Japanese producers to increase exports to the United States without resort to production shifting.[151]

The data collected during the investigation indicate that the domestic vector supercomputer industry has not been performing well during the period of investigation, and its ability to generate funds to continue future research and development is impaired. This is consistent with the reported decline in research and development expenditures.[152] In an industry such as the vector supercomputer industry, where technical innovation is a prerequisite to remaining competitive, the availability of sufficient research and development funds is imperative. The subject imports threaten to impede the domestic industry's ability to fund future research and development.

The industry's current weakened financial condition due to restructuring expenses, the shift in demand from large scale to lower-margin mid-range systems, declining government sales, and overall declining profitability makes it particularly vulnerable to such adverse effects of the dumped imports. Based on these industry conditions in combination with the rise of subject import volumes and market share, the Japanese producers' attempts to increase exports to the United States, apparent excess foreign capacity, and the evidence of underbidding, we find that LTFV imports pose a threat of material injury to the domestic industry producing vector supercomputers.[153]

Finally, we do not determine that, but for the suspension of liquidation in April, 1997, we would have found that the domestic industry is materially injured by reason of the subject imports.

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[146] CR at V-30-31, PR at V-6.

[147] As stated by ***. CR at V-32, PR at V-6.

[148] CR at VII-5, PR at VII-3. However, HNSX reported *** in inventory in 1995, and HNSX and Fujitsu reported a total of *** in inventory in 1996. CR at VII-5, PR at VII-3.

[149] CR at VII-1, PR at VII-1.

[150] CR at VII-2, PR at VII-1.

[151] Fujitsu's Prehearing Brief at 91.

[152] Table VI-3; CR at VI-7, PR at VI-3.

[153] We have considered the current condition of the domestic industry as among the "relevant economic factors" in our threat analysis.

CONCLUSION

For the foregoing reasons, we determine that the domestic industry producing vector supercomputers is threatened with material injury by reason of LTFV imports from Japan.

PART I: INTRODUCTION

BACKGROUND

This investigation results from a petition filed by Cray Research, Inc., Eagan, MN, on July 29, 1996, alleging that an industry in the United States is materially injured and threatened with material injury by reason of LTFV imports of vector supercomputers[1] from Japan. Information relating to the background of the investigation is provided below.[2]

Date	*Action*
July 29, 1996	Petition filed with Commerce and the Commission; institution of Commission investigation
August 23, 1996 . . .	Initiation of Commerce investigation
September 11, 1996 .	Commission's preliminary determination
April 7, 1997	Commerce's preliminary determination; commencement of Commission's final phase investigation (62 FR 24973, May 7, 1997)
August 20, 1997 . . .	Commerce's final determination (62 FR 45623, August 28, 1997)[3]
August 27, 1997 . . .	Commission's hearing[4]
September 26, 1997 .	Commission's vote
October 3, 1997	Commission determination transmitted to Commerce

SUMMARY DATA

A summary of data collected in this investigation is presented in appendix C.[5] Except as noted, U.S. industry data are based on CRI's questionnaire response that accounted for an estimated *** percent

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[1] For purposes of this investigation, "vector supercomputers" are all vector supercomputers, whether new or used, and whether in assembled or unassembled form, as well as vector supercomputer spare parts, repair parts, upgrades, and system software shipped to fulfill the requirements of a contract entered into on or after Apr. 7, 1997, for the sale and, if included, maintenance of a vector supercomputer. A vector supercomputer is any computer with a vector hardware unit as an integral part of its central processing unit boards. Vector supercomputers are provided for in heading 8471 of the HTS, with most-favored-nation tariff rates ranging from free to 2.0 percent *ad valorem* applicable to imports from Japan. Parts for supercomputers are provided for in heading 8473 of the HTS, with most-favored-nation tariff rates of free applicable to imports from Japan.

[2] *Federal Register* notices cited in the tabulation are presented in app. A.

[3] Final LTFV margins as calculated by Commerce are as follows: 173.08 percent for Fujitsu, 454.00 percent for NEC, and 313.54 percent for all other Japanese exporters/manufacturers. The margins for Fujitsu and NEC were based on best information available. Commerce determined that an adverse inference is appropriate for these two companies since NEC refused to respond to Commerce's questionnaire and Fujitsu decided not to fully respond to Commerce's supplemental cost questionnaire or to other requests for information by Commerce.

[4] A list of participants at the hearing is presented in app. B.

[5] Table C-1, vector supercomputers measured in systems; table C-2, vector supercomputers measured in gigaflops; table C-3, MPPs measured in systems; table C-4, SMPs and SPPs measured in systems; and table C-5, total supercomputers measured in systems.

I-1

of total U.S. supercomputer factory revenue in 1996.[6] U.S. import data are based on information supplied by U.S. importers that are believed to account for 100 percent of the subject systems from Japan.

THE PRODUCT

Commerce has defined the product that is the subject of this investigation as all vector supercomputers, whether new or used, and whether in assembled or unassembled form, as well as vector supercomputer spare parts, repair parts, upgrades, and system software shipped to fulfill the requirements of a contract for the sale and, if included, maintenance of a vector supercomputer. A vector supercomputer is any computer with a vector hardware unit as an integral part of its central processing unit boards. This definition describes a particular type of supercomputer that consists of hardware designed to process data in a specific way and the software that enables the computer to function in this specific way. The other types of supercomputers that the petitioner believes are not part of the vector market are MPPs, SMPs, and networked workstations. Respondents NEC and Fujitsu believe that all supercomputers share the same essential characteristics and perform the same function, regardless of architecture.[7] Depending on the classification criteria used to describe the architecture or operation of a supercomputer, these types of non-vector, parallel computer systems may process data differently[8] and may require software different from that of vector supercomputers. Despite these differences, the markets for vector and non-vector supercomputer systems overlap to some extent.[9] Also, parallel processing architecture has many forms and other configurations exist that are not mentioned by the petitioner. This section presents information on both imported and domestically produced vector supercomputers, as well as information related to the Commission's "domestic like product" determination.[10]

It is difficult to define the term "supercomputer" in concrete, measurable terms because the product has changed over time. Generally, supercomputer systems are differentiated from other computers by two factors--high processing speeds and an ability to handle numerically intensive problems too large for conventional computers. Another general distinction is the existence of a low latency, high bandwidth

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[6] Total revenues for supercomputers in 1996 as reported by Dataquest were $***. CRI's percentage share was calculated from the revenues reported in its questionnaire response; however, no ***.

[7] Hearing transcript, p. 103.

[8] Fujitsu argues that the term "vector processor" is distinct from "vector processing" of data. A vector processor refers to the type of processor hardware, while vector processing of data may be conducted with non-vector processors; Fujitsu's postconference brief, p. 8.

[9] Witnesses for NEC testified at the hearing that there is almost a complete overlap between vector and non-vector supercomputers for CRI's vector applications and that there is a complete overlap between vector and non-vector supercomputers for the most important commercial supercomputer applications; see exh. 1 submitted by counsel on behalf of NEC and HNSX at the hearing, and prehearing brief, exh. 1, attachments 7-9. On the other hand, CRI maintains that there are many applications where there is no overlap.

[10] The Commission's decision regarding the appropriate domestic products that are "like" the subject imported products is based on a number of factors, including (1) physical characteristics and uses; (2) interchangeability; (3) channels of distribution; (4) customer and producer perceptions; (5) common manufacturing facilities and production employees; and, where appropriate, (6) price.

interconnect in supercomputers,[11] which allows rapid communication or message passing among processors.[12] Innovations in mainframes, semiconductor technology, and networking have enabled some computers or systems of computers to challenge the superiority of traditional supercomputers in processing speed and/or power. Although these advancements have prompted a number of computer manufacturers to label their products supercomputers, not all of these systems have the capability to handle effectively the most advanced scientific and commercial applications at the speed of a true supercomputer.

At the hearing, NEC and UCAR representatives stated that supercomputers are clearly differentiated from other computers by the presence of high-speed processors and interconnects. Specifically, NEC representatives stated that network technologies commonly used to connect personal computers and workstations such as FDDI, Ethernet, Fast Ethernet, and ATM would not currently be used for a supercomputer system. NEC representatives added that internal communications between processors on non-supercomputer systems are generally bus-based interconnection technologies.[13] However, the SGI PowerChallenge is a bus-based computer which NEC includes in its classification of supercomputers.[14] In its posthearing brief, NEC argued that the high-speed interconnect issue is really an issue concerning the low latency and high bandwidth metrics of supercomputer systems as compared to conventional computers. For example, NEC states that an Ethernet connection is 500 microseconds in terms of latency, whereas supercomputer latencies range from a high of 83 microseconds to a low of less than 1 microsecond. In terms of bandwidth, an Ethernet connection has a bandwidth of 0.9 MB/second while supercomputer bandwidths are 13 MB/second and up.[15] NEC did not compare the latencies or bandwidth performance of certain high-end enterprise servers at the hearing or in its posthearing brief, but high-end server manufacturers such as *** responded that they did not produce supercomputers as defined by the Commission.

The petitioner, CRI, ***.[16] When asked specifically about differences between low-end supercomputers and high-end enterprise servers, CRI responded that ***.[17] However, in its posthearing brief, CRI ***.[18] In addition, CRI suggests that ***.[19]

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[11] ***, and NEC's posthearing brief, pp. 19-20.

[12] Aad J. Van der Steen and Jack J. Dongarra, *Overview of Recent Supercomputers*, World Wide Web, http://www.netlib.org/utk/papers/advanced-computers/paper.html, Feb. 20, 1997, and meeting with NEC representatives, July 23, 1997.

[13] Hearing transcript, pp. 126-128, 133-136, 140-141, and 180-183. See also, UCAR's posthearing brief regarding a definition of a supercomputer, p. 8.

[14] Challenge Family, World Wide Web, http://www.sgi.com, Aug. 28, 1997, and NEC's prehearing brief, exhs. 1-5.

[15] NEC's posthearing brief, pp. 18-20.

[16] Meeting with CRI representatives, Sept. 2, 1997. ***. Also cited in petitioner's posthearing brief, Answers to Commission Question #7, The Vector Supercomputer Market in 2001: An SGI/CRI perspective on the market and product plans to address the vector supercomputer market, p. 6.

[17] Meeting with CRI representatives, Sept. 2, 1997.

[18] CRI's posthearing brief, Answers to Commission Questions #3 and #7, pp. 6-7, 13-15.

[19] CRI's posthearing brief, pp. 3 and 8, and Answers to Commission Question #3, pp. 1-2.

I-3

Supercomputers can be divided into two main categories: vector supercomputers and various types of parallel systems.[20] Vector supercomputers are designed to perform operations on sets of numbers called vectors. The processor treats each vector as a single entity; thus, performing an operation on a set of numbers arranged in a vector array requires only one instruction. Computers with vector processors are useful in a variety of applications characterized by a large volume of data that can easily be organized into lists when the program is written. The number of processors in parallel systems can range from a few to many, and this characteristic is referred to as scalability. Part of the program and the data are assigned to each processor, and all processors carry out the required operations simultaneously. Necessary communications between processors, to obtain additional data, for example, are handled by the routing network, which transfers messages within the computer system. Because message passing can slow the machine's overall speed, parallel processing is best suited to problems with many small parts that can be computed independently. The greater the number of processors, the more important it is to limit the connections to the pattern best tailored to the jobs the computer will run.[21]

The petition provides examples of both imported MPPs with vector hardware, which are included within its like product definition of vector supercomputers, and domestically produced mainframe computers with a vector facility that is not an integral part of the mainframe CPU boards and, therefore, are not included in its definition.[22] According to CRI, vector supercomputers are different from parallel computers without vector processor hardware and networked workstations in terms of their architecture, physical characteristics, and availability of third-party application codes.[23] CRI maintains that vector supercomputers are used in applications for which other types of supercomputing platforms (e.g., MPPs or SMPS) are not well suited or for which the investment in software written for vector architecture is too great to justify a switch to an alternative architecture.[24] The difference between vector and non-vector supercomputers is described as a function of the use to which the supercomputer is put.[25] CRI discussed in further detail its like product arguments in its prehearing and posthearing briefs.[26]

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[20] Vector supercomputers with multiple processors could also be considered parallel systems, as a broad interpretation of the term "parallel" includes all computers with more than one processor. Fujitsu argues that this distinction is an oversimplification of supercomputer technology; Fujitsu's prehearing brief, pp. 8 and 14. CRI argues that there is a clear physical distinction between vector and non-vector systems; hearing transcript, pp. 14-15.

[21] Petition, annex B, pp. 60-61 and 63.

[22] Petition, pp. 8, and 10-11. A key to petitioner's definition of like product is that the vector facility be an integral part of any of the computer's CPU boards; CRI's prehearing brief, pp. 9-13, and posthearing brief, pp. 3-4.

[23] Ibid, pp. 14-18, and annex B. See also testimony of Steve Oberlin, CRI, conference transcript, pp. 21-41. ***; staff meeting with CRI representatives, Sept. 2, 1997.

[24] ***; staff meeting with CRI representatives, Sept. 2, 1997. See also CRI's posthearing brief, pp. 6-7. In a meeting with representatives for three government agencies, the staff was told that ***, Sept. 8, 1997. However, UCAR provided a letter from Dr. Hack, NCAR, (exh. A, posthearing brief) in which he states that migrating NCAR's existing application codes from parallel vector architectures to non-vector SMP architectures is "a trivial exercise."

[25] CRI's prehearing brief, pp. 7-8.

[26] CRI's prehearing brief, pp. 6-31, and posthearing brief, pp. 3-10, and Answers to Commission Question #3.

Respondents argued at the hearing that other types of supercomputers should be included in the like product and thus their producers included in the U.S. industry.[27] Specifically, they argued that MPPs and SPPs/SMPs should be included in the like product.[28] U.S. imports of supercomputers from Japan to date have been almost entirely vector supercomputers or vector-parallel supercomputers.[29] They have been relatively low-end supercomputers, both in number of processors and peak performance measured in Gflops, compared with the universe of vector supercomputers and compared with the full product line of supercomputers manufactured by NEC, Fujitsu, and CRI. Technologically, they are similar to some, but not all, supercomputers manufactured in the United States.[30]

Physical Characteristics and Uses

The manufacture of vector and non-vector supercomputer hardware in both Japan and the United States begins with a significant amount of research, development, and design, because these computers are configured differently for each order and include significant proprietary technology to enable them to process large volumes of data at high rates of speed. The actual manufacturing process consists mainly of assembly of various parts, including semiconductors, printed circuit boards, internal wiring, power supplies, I/O devices, and any other parts that a system requires to meet the user's specifications. In addition to these basic operations, many vector and non-vector supercomputer manufacturers design and/or manufacture specialty high-performance semiconductors or other components for their computers.

There are differences in the technologies employed in the manufacture of supercomputers; however, these differences are between manufacturers, not between the imported and the domestic products. From the information available at this time, it appears that CRI is the only supercomputer manufacturer using ECL for the processors in any of its supercomputers, and CRI's use of ECL is restricted to one current model of vector supercomputer, the T90. CRI produces ECL processors in Chippewa Falls, WI, and outsources most, if not all, other processors, although they contain a high level of proprietary design.

Both U.S. and foreign companies use CMOS technology for their processors. Japanese producers and most U.S. parallel systems producers, with the exception of SGI/CRI, are integrated firms with broad product lines that can take advantage of spill-over benefits of research and development. In the case of the Japanese producers NEC and Fujitsu, the research, development, and plant and equipment costs of advanced CMOS logic chips are shared with costs of mass-market memory chips. The merchant market and internal demand for higher density DRAMs has driven the development of new CMOS technology.

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[27] Hearing transcript, pp. 103-125; Fujitsu's prehearing brief, pp. 4-30; and NEC's prehearing brief, pp. 4-40, and posthearing brief, pp. 6-7.

[28] NEC's prehearing brief, pp. 10-15, and Fujitsu's prehearing brief, pp. 4-8. In its importers' questionnaire response, Fujitsu stated that ***. HNSX provided some specific examples of *** in its questionnaire response, pp. 11C-11F. HNSX noted that ***.

[29] Fujitsu ***.

[30] Fujitsu noted that NEC and Fujitsu have primarily competed in the United States in the HPMR market segment where IDC concedes there is substantial overlap with non-vector systems; Fujitsu's prehearing brief, p. 13 and ex. 1, and posthearing brief, pp. 2-3. CRI noted that "***"; CRI's posthearing brief, Answers to Commission Question #7, The Vector Supercomputer Market in 2001: An SGI/CRI perspective on the market and product plans to address the vector supercomputer market, Sept. 1997, p. 4.

Supercomputer logic chips are designed as a follow-on to developments made in DRAMs, and each innovation is amortizable over a broad product base. In these companies, supercomputer logic chips are produced in the same facilities on manufacturing lines parallel to those producing commodity logic chips; designs for supercomputer logic chips take advantage of developments in the next generation of memories.[31]

The purchase of a supercomputer also generally includes software, auxiliary equipment, and services. At a minimum, the purchase includes operating system software. Such software is developed by the supercomputer manufacturer, and most is based on the widely used Unix operating system. Some purchases may also include some applications software developed by the hardware manufacturer. Auxiliary equipment (other than the I/O devices and power supplies) such as the cooling system may also be designed and assembled by the computer hardware manufacturer. Construction design and services, on-site maintenance and repair services, and user assistance are usually included in the contract price.

All supercomputers process large amounts of data at a very high rate of speed. However, there are a number of designs or architectures that use different technologies to achieve this result. Each architecture and technology has advantages and disadvantages. The performance of the system and its suitability for certain applications are determined by the total system and software and not by any particular feature. The following discussion describes the main features of the different architectures and technologies and their advantages and disadvantages.

Architectures

Classification of supercomputer systems is a difficult task as there exists no clear cut or agreed upon method to distinguish among the different types of architectures. For instance, depending on the criteria, supercomputers may be characterized by performance level, number of processors, type of processor, type of information or instruction flow, memory structure, interconnection or communications technology, or a combination of these and other distinctions. The petitioner distinguishes supercomputer architectures based on processor hardware, whereas Fujitsu and NEC advocate a classification based on system memory structure (distributed versus shared).[32]

Vector supercomputers use hardware specially designed to process data in groups called vectors.[33] This is particularly well suited to simulating complex problems over time, for example the operation of a

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[31] High Performance Computing Lab, University of Texas at San Antonio, World Wide Web, http://rabbit.cs.utsa.edu/Welcome.html, Aug. 21, 1996.

[32] NEC's prehearing brief, pp. 11-15 and exh.1, attachments 1 through 5; Fujitsu's prehearing brief, pp. 10-19; and Supplemental Response of HNSX to the importers' questionnaire.

[33] Fujitsu states that vector processing may be conducted by RISC processors without vector processor hardware; Fujitsu's postconference brief, p. 8. Fujitsu points out that IDC includes vector-based minisupercomputers (e.g., CRI's J90) and RISC-based advanced architecture servers (e.g., DEC's Advantage Cluster, IBM's RISC System/6000 SP, SGI's Power Challenge), as well as many of Fujitsu's VPP300 vector systems and NEC's SX-4B vector systems with its HPMR systems; Fujitsu's prehearing brief, pp. 10-11 and exh. 1, and posthearing brief, pp. 2-3. CRI notes that IDC treats high-end vector systems, which represent about 70 percent of the value of all vector supercomputer sales, as a distinct market category; CRI's posthearing brief, pp. 8-9 and Answer to Commission Question #1, 1.B, Future Product Buying Intentions and Market Forecast by IDC. Fujitsu also believes that RISC technology will continue to gain ground against special proprietary architectures, forcing proprietary vector systems into an ever-smaller and more specialized niche in the market; prehearing brief, p. 13.

jet engine from take off to landing or climate changes over decades.[34] Most vector supercomputers have one large shared memory (Fujitsu vector supercomputers have memory that is not shared by multiple processors, rather each individual processing element has its own or distributed memory),[35] and programming is specially designed to minimize the time required to bring needed data from memory to processors and to the appropriate output device.[36] Another characteristic of vector supercomputers is the general use of custom processing elements or processing elements, with a very high degree of customization, that number only in the 10s. The vector hardware in a supercomputer allows processing of many data items as a group rather than individual items and of working on more than one instruction at the same time.[37] The ability to process data using more than one processor (parallel processing), and thus decrease the time to solution, is a characteristic that has been incorporated in vector computers for at least a decade. Multiprocessor vector supercomputers are also generally referred to as PVPs.

Non-vector parallel processing systems vary widely in architecture, performance, and applications. The one thing they have in common is multiple processing elements, and these processing elements are often commodity logic chips with little or no customization. The distinguishing characteristics are their internal communications systems, memory structure, and the number of instruction units that communicate with the processing elements. These differences prevent programming for one type of parallel processing computer from being compatible with other configurations.[38]

The first parallel processing computers consisted of many processing elements, each with its own memory (distributed memory), and one instructional unit, which delivered the same instruction to all the processing elements. Each processing element then executed the instruction on the data in its memory. This type of parallel system is also referred to as a distributed memory computer with single instruction, multiple data streams of information.[39] There are major drawbacks to this type of system. First, a new instruction could not be given until all the processors had finished the current instruction. If one processor's data were complex and took longer to process, all the other processors would be idle while waiting for the last processor to finish. As a result, processing speed could decrease dramatically. Second, programming was difficult because it had to be structured to distribute all of the processing assignments equally and continuously. All processors had to be given assignments continuously and those assignments would have to be designed to take exactly the same amount of time for each processor and its data set. Few of these parallel processing computers are still in use today. They were very difficult to program efficiently and were not compatible with any standard software. In addition, applications that could be structured to run fast on an architecture such as this were rare.[40]

The next type of parallel processor is one that consisted of many memory/processor/instruction units tied together with a message passing network. This type of parallel system is commonly known as a

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[34] "The World's Fastest Computers," Byte, vol. 21, No. 1, Jan. 1996, p. 45, and meeting with ***, Sept. 8, 1997.

[35] Fujitsu's prehearing brief, pp. 16-17.

[36] NEC argues ***; meeting with NEC representatives, July 23, 1997.

[37] "The World's Fastest Computers," Byte, vol. 21, No. 1, Jan. 1996, p. 45, and Computational Science Education Project--Computer Architecture, World Wide Web, http://www.http://csepl.phy.ornl.gov/, Sept. 1995.

[38] National Academy Press, World Wide Web, http://www.nap.edu, Aug. 21, 1996.

[39] Aad J. Van der Steen and Jack J. Dongarra, *Overview of Recent Supercomputers*, World Wide Web, http://www.netlib.org/utk/papers/advanced-computers/paper.html, Feb. 20, 1997.

[40] National Academy Press, World Wide Web, http://www.nap.edu, Aug. 21, 1996.

distributed memory computer with multiple instruction, multiple data streams of information.[41] Because each of these units is essentially a computer on its own, it could operate on instructions independently from the other units and coordinate activities by message passing. This structure avoided the problem of one processor holding up the work of all the others, but it also had problems. The main drawback of this system was that the speed with which a message traveled through the network often was slower than the speed of the processors. If communication between processing units was frequent, the overall speed of the computer would fall significantly and as the number of processing units increased, the message passing delays increased. In order to minimize these problems, processors had to have access to the data they needed in their own memories or in only a few nearby locations, programs had to be written to minimize the need for message passing, and message passing networks had to be made faster and more efficient. This parallel processing computer design ranges from MPPs with hundreds of processing units located in one cabinet and connected by a high-performance network to a cluster of workstations connected by LANs or WANs.[42] The MPP configuration, with the appropriate programming, can be a very powerful high-performance computer. The cluster of workstations may perform well if message passing is minimized, but the network connections are likely to severely restrict the overall speed of the system. Also, clustered workstations are not likely to perform well on very large simulations, especially if the problem is time sensitive. As a result, a cluster of workstations approach for supercomputer applications is not widely used.[43] An MPP type of parallel system, exemplified by IBM's SP2, is able to run more applications with greater efficiency and software tools are increasingly approaching those available for vector computers, mainframes, and workstations. These computers were the first to use off-the-shelf microprocessors and represented a significant cost advantage over traditional vector supercomputers.[44]

A third type of parallel processing computer is one that has multiple processing units sharing a common memory and is sometimes referred to as an SMP. These supercomputers are also known as shared memory systems with multiple instruction, multiple data streams of information.[45] Each processing unit contains a processing element, an instruction unit, and cache memory.[46] Cache memory is a small, very fast memory between a processor and main memory and is used because the main memory is not capable of transferring data to the processor as fast as it can be processed.[47] NEC argues that cache memory is not unique to supercomputers of this type and appears in MPP as well as certain vector

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[41] Aad J. Van der Steen and Jack J. Dongarra, *Overview of Recent Supercomputers*, World Wide Web, http://www.netlib.org/utk/papers/advanced-computers/paper.html, Feb. 20, 1997.

[42] National Academy Press, World Wide Web, http://www.nap.edu, Aug. 21, 1996.

[43] Experiments with clusters of workstations have been conducted in academic environments. David E. Culler, Andrea Arpaci-Dusseau, Remzi Arpaci-Dusseau, Brent Chun, Steven Lumetta, Alan Mainwaring, Richard Martin, Chad Yoshikawa, Frederick Wong, "Parallel Computing on the Berkeley NOW," Computer Science Division, University of California, Berkeley, to appear in *JSPP'97 (9th Joint Symposium on Parallel Processing)*.

[44] "The World's Fastest Computers," Byte, vol. 21, No. 1, Jan. 1996, pp. 46, 52, 54, and 58; and I.E. Stockdale and John Barton, "Compute Server Performance Results," NAS Technical Report, NAS-94-004, Nov. 1994.

[45] Aad J. Van der Steen and Jack J. Dongarra, *Overview of Recent Supercomputers*, World Wide Web, http://www.netlib.org/utk/papers/advanced-computers/paper.html, Feb. 20, 1997.

[46] National Academy Press, World Wide Web, http://www.nap.edu, Aug. 21, 1996.

[47] SGI, World Wide Web, http://www.sgi.com, Aug. 23, 1996.

systems.[48] There is a limit on the number of processing units in this configuration because communication with shared memory impinges on speed as the number of processors increases. An example of a non-vector SMP computer is the SGI Power Challenge.[49]

To avoid the bottleneck that results when adding more processors to an SMP-type system, nodes, each consisting of a basic SMP system discussed above, can be joined together with a second tier (or multiple tiers) of memory. This two- or multiple-tier memory structure behaves much like shared memory and appears as such to a programmer. This type of supercomputer, SPP, can include very large numbers of processors and still be a high-speed computer. This is the most fully developed parallel processing architecture, and it can solve a wider range of problems more efficiently than other types of parallel computers. This type of computer can be considered a combination of distributed and shared memory architectures as each node has its own memory but accesses yet another memory space shared with other nodes. In terms of information streams, this type of parallel computer is considered a multiple instruction, multiple data machine.[50] Examples of SPP technology are the SGI/CRI Origin 2000 and the Convex Exemplar.[51]

Processors

Several classes of processors are used in supercomputers. Custom logic chips are used in vector computers, but commodity chips are used in most other supercomputers. The CRI T90, CRI's highest performance vector computer, uses ECL technology; nearly all other supercomputer producers use CMOS technology in their processors. With the introduction of powerful new CMOS microprocessors such as the IBM Power2 SuperChip (P2SC), the MIPS R10000, and the DEC Alpha processors, supercomputing increasingly has moved to CMOS microprocessor-based systems.[52] Logic technologies to be preferred are those with both low gate delays and low power dissipation per gate. Unfortunately, neither ECL nor CMOS embodies both of these characteristics. The traditional logic technology used for high-performance computers, ECL, is the fastest of the silicon technologies. ECL is expensive to manufacture and use and requires a more expensive (liquid) cooling system. CMOS has lower power dissipation than ECL and requires a less costly (air) cooling system. The lower power dissipation makes it possible to achieve high densities of gates per chip; the higher gate density makes it possible to incorporate more functions per chip and therefore avoid transmission delays from chip to chip. Offsetting this advantage, CMOS has a major disadvantage as a logic technology for supercomputers--its gate delay is higher than ECL.[53]

However, the speed of the processor is not the only factor in supercomputer speed. The type of memory and the speed of the network connecting the memory, processing elements, and the I/O devices,

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[48] Meeting with NEC representatives, July 23, 1997.

[49] Aad J. Van der Steen and Jack J. Dongarra, *Overview of Recent Supercomputers*, World Wide Web, http://www.netlib.org/utk/papers/advanced-computers/paper.html, Feb. 20, 1997.

[50] Ibid.

[51] Ibid.

[52] Jack Dongarra, Hans Meuer, Horst Simon, Erich Strohmaier, "Changing Technologies of HPC," World Wide Web, http://www.netlib.org/utk, Sept. 2, 1997.

[53] Academy Industry Program, Supercomputers, National Academy Press, Washington, DC, 1989, pp. 39-40.

I-9

together with the software and type of application, all contribute to the ultimate speed and processing power of the computer.

Supercomputers are used for data-processing applications that involve massive amounts of data and a huge number of calculations. They are also used to process large numbers of smaller problems virtually simultaneously. Traditionally, government[54] and university research centers have been the largest users of supercomputers. Supercomputers have also been used for industrial applications for many years. The automotive, aerospace, and petroleum exploration industries are among the largest industrial markets for vector and non-vector supercomputers.[55] These industries have used supercomputers to simulate automobile prototype crash tests to speed time to market, in fluid dynamics to create more efficient airplanes, and in reservoir flows to more accurately predict oil and gas reserves. Other industrial applications have included designing America's Cup yachts and cardiac pacemakers, processing bank and stock market transactions, and analyzing demographic and inventory flow data.[56]

Use of Common Manufacturing Facilities and Production Employees

For a discussion of common manufacturing facilities and employees, see the section in part II entitled "Production Alternatives."[57]

Interchangeability[58]

In general, both U.S. and Japanese vector supercomputers are viewed by purchasers as being interchangeable if they meet the purchaser's specifications and computational needs.[59] Exact specifications of competing U.S.-produced and imported Japanese vector supercomputer bids, however, may differ substantially with respect to physical characteristics and other factors.[60]

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[54] The national security and defense areas of the government have traditionally used vector supercomputers (Fujitsu's posthearing brief, Responses to Commission's Questions, p. 3, and NEC's posthearing brief, p. 25), although non-vector systems are now in use at DOE's three national laboratories-Sandia, LLNL, and Los Alamos (New York Times article, Sept. 2, 1997). ***. The machines selected for the ASCI program are from Intel, IBM, and SGI/CRI, ASCI-Platforms, World Wide Web, http://www.lanl.gov/projects/asci/Platforms.html, Sept. 9, 1997.

[55] Sales to environmental, *** customers accounted for *** percent of CRI's vector supercomputer revenues in 1996; CRI's posthearing brief, p. 2, and chart attached to Answer to Commission Question #5.

[56] For a more detailed discussion of end uses see CRI's prehearing brief, pp. 14-18, and posthearing brief, pp. 5-7 and responses to Commission questions; Fujitsu's prehearing brief, pp. 17-19; and NEC's prehearing brief, pp. 16-17 and exhs. 3-5.

[57] See also CRI's prehearing brief, pp. 28-30; NEC's prehearing brief, pp. 29-31; and Fujitsu's prehearing brief, pp. 25-26.

[58] For additional information on interchangeability see "Substitute Products" in part II of this report.

[59] For large projects, such as the UCAR project, which test many benchmarks, competing systems might perform better on some benchmarks and worse on others. In addition, there is the question of performance of core requirements vs. performance on expectations. A system could meet the core requirements but still be vastly outperformed by a competing system on expectations.

[60] For a more detailed discussion comparing domestic and imported vector supercomputers, see part II of this

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I-10

As a technical matter, virtually all codes that run on a vector system can be run on non-vector architectures.[61] In practice, certain codes run much more efficiently and quickly on vector systems than on non-vector systems. The factors that play a role in determining the interchangeability of the various architectures and performance ranges of supercomputers include the following:

- the time sensitivity of the application
- the complexity of the problem
- the size of the data set
- the applications software that has already been developed
- the resources that can be devoted to software development/modification
- the system's price
- the cost to maintain the system
- the presence of parallelism in the application
- the ability to expand the system (scalability)

There are certain trade-offs that can be made that could convince users to consider different types of supercomputers to be interchangeable. Cost is an important consideration. Purchasers may be willing to spend resources to convert vector software programs for use on parallel computers because the cost of the parallel system may be less. Another trade-off is scalability, which is an important feature that allows for future expansion, and it is available to a greater degree in non-vector parallel systems. Communications with other computers and proprietary languages are less important concerns, because Unix is the principal operating system for both supercomputers and workstations.

Several factors indicate that not all supercomputers are interchangeable. In parallel computing there are several types of systems or features of systems that may make them a poor choice for some applications; for example, parallel computers with only one instruction unit and processors that work in lock-step are not good choices for most applications. Clustered workstations, at the low end of the distributed memory parallel processing systems, are not likely to perform well on very large simulations, especially if the problem is time-sensitive. The structure of the application can have a significant effect on the performance of different supercomputers. Applications that consist of many independent calculations, those that can be parallelized, may run more efficiently on a parallel processing computer.[62] Applications that are highly scalar (those that require serial processing) usually run faster on vector supercomputers. However, innovative memory or other design and software can mitigate the differences.

Migrating, or converting, and optimizing software application codes from vector to non-vector supercomputers is a crucial issue in terms of interchangeability. In many cases, vector supercomputers and some types of parallel processing machines are performing similar analyses and, therefore, appear to be interchangeable.[63] However, this assumes that comparable software has been developed for each

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[60] (...continued)
report.

[61] CRI's posthearing brief, p. 6.

[62] As noted earlier in the report, meeting with ***, Sept. 8, 1997.

[63] At the hearing Dr. Hammond, testifying on behalf of UCAR, responded that their vector and non-vector systems were largely interchangeable; hearing transcript, p. 194. In its posthearing brief, CRI points out various
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I-11

computing platform. There is already a considerable library of vector computer programs and the library of parallel computing programs is growing.

In addition to Dr. Hammond's statement, NEC representatives argued at the hearing that "(a)ny code developed to run on a Cray T90 will run efficiently on an SMP shared memory, non-vector supercomputer, such as SGI's Power Challenge"[64] and the conversion of vector software codes to non-vector MPP supercomputers has been aided by various software tools.[65] Both the petitioner and respondents agreed that most third-party software applications for supercomputers can run on different platforms;[66] however, the degree of efficiency or optimization of third-party and proprietary software is contested. NEC stated at the hearing and in related briefs that 82 percent of CRI's vector software applications were known to run on non-vector platforms and that all of the "most widely used (commercial, third party) supercomputer applications" run on both vector and non-vector supercomputers.[67] CRI, however, argued that most purchasers of vector supercomputers continue to buy these products because critical or time-sensitive analyses conducted on certain commercial and proprietary software applications are not optimized to run at an acceptable performance level on non-vector platforms.[68] ***.[69] In terms of proprietary, or in-house, software, CRI also mentioned that the effort to migrate and optimize proprietary vector software to non-vector platforms may be too great to warrant a switch.[70] CRI added that, according to their market study, ***.[71]

All parties agreed that a base of core customers with critical applications continue to see vector systems as the only feasible solution to their computing needs and have continued buying these products.[72] NEC stated that for certain national security applications, vector systems are currently used and will most probably be used for some time and that, in some cases, these users have no incentive to switch to non-vector supercomputers. However, NEC argued that in the commercial sector, vector and non-vector

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[63] (...continued)
inconsistencies in this testimony (hearing transcript, pp. 202-203, posthearing brief, p. 5) and provided a copy of an analysis published by Dr. Hammond detailing the problems that NCAR had encountered when it attempted to run its programs on an MPP architecture (Beyond Machoflops: Getting MPPs into the Production Environment, NCAR, Jan. 1995, posthearing brief, exh. 1.E. to Commission Question #1).

[64] Hearing transcript, p. 110.

[65] Ibid., p. 111.

[66] Hearing transcript, p. 112; NEC's prehearing brief, pp. 18-27, exh. 1, p. 10, and exhs. 1-8 and 1-9; and CRI's posthearing brief, Answers to Commission Question #1, p. 3.

[67] Hearing transcript, p. 112, and NEC's prehearing brief, pp. 18-27, exh. 1, p. 10, and exhs. 1-8 and 1-9.

[68] CRI's posthearing brief, Answers to Commission Question #1, pp. 1 and 3, exhs. 1-A, 1-C, 1-D, and 1-E, and #7, pp. 5-6.

[69] CRI's posthearing brief, Answers to Commission Question #1-C, p. 5.

[70] Ibid.

[71] CRI's posthearing brief, Answers to Commission Question #1-B, #7, pp. 8-9. Fujitsu disagreed with the methodology, results, and conclusions of the survey as presented in CRI's questionnaire; prehearing brief, pp. 28-29.

[72] CRI's posthearing brief, Answers to Commission Questions #1, pp. 1 and 3; exhs. 1-A, 1-C, 1-D, and 1-E, and #7, pp. 5-6. NEC's posthearing brief, pp. 16 and 25. Fujitsu's posthearing brief, pp. 3-4 and 19-20. Also see, meeting with ***, Sept. 8, 1997.

systems compete based on the needs of the purchaser.[73] Fujitsu also agreed that in certain very high-end applications, such as national security and defense, vector systems will continue to be an important factor. Like NEC, Fujitsu argued that interchangeability for the vast majority of applications in the commercial sector is based on a purchaser's evaluation of supercomputer performance and not whether the system is vector or non-vector.[74]

In a related argument, CRI introduced a concept of intertemporal and intratemporal interchangeability during the hearing. According to CRI's testimony, CRI acknowledged that changes in technology over time may result in an older vector supercomputer being replaced by a newer alternative platform to perform the same functions. However, CRI contends that intratemporally, or at a given point in time, there will be a set of applications and uses that are uniquely suited to vector supercomputers.[75] The respondents argued that there is no evidence of a "clear dividing line" between vector and non-vector supercomputers at any given point in time.[76]

Channels of Distribution

Both U.S. and Japanese vector supercomputers are sold either by the manufacturer's direct sales force or on a competitive-bid basis for contracts announced by purchasers. The contracts are generally for entire systems, which almost always require extensive software and installation support and on-site engineering by the manufacturer for the system's operational life (usually 5 years). Included with the system (and generally provided for in the contract) are certain spare parts to facilitate the speed of repairs, upgrades, and maintenance. Vector supercomputers are sold to end users that tend to be research laboratories and other scientific institutions; government agencies involved in defense, intelligence, and aerospace; climate modeling and weather forecasting institutions; and large corporations with demanding modeling and/or simulation requirements (e.g., automobile producers, petroleum companies, and aerospace companies).[77] [78] Other supercomputers are sold in much the same way. Aftersales service and support would be minimal. DEC stated that ***.[79]

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[73] NEC's posthearing brief, pp. 16 and 25.

[74] Fujitsu's posthearing brief, pp. 3-4 and 19-20.

[75] Hearing transcript, pp. 16-19 and 50-54, CRI's posthearing brief, p. 10 and Answers to Commission Question #1. See also, meeting with ***, Sept. 8, 1997.

[76] Hearing transcript, pp. 176-180; NEC's posthearing brief, pp. 6-9; and Fujtsu's posthearing brief, pp. 9-11.

[77] Petition, p. 12. Staff meeting with CRI representatives, Sept. 2, 1997.

[78] Parallel computers are used extensively in scientific (such as weather modeling) and industrial (such as the automotive industry, the oil and gas industry, and the finance industry) applications; Benchmark Programs and Reports, World Wide Web, http://www.netlib.org/benchmark, June 19, 1997.

[79] Telephone conversation with ***, Aug. 20, 1997.

I-13

Price

The movement toward scalable MPP and SMP/SPP systems has eliminated most of the potential growth in traditional vector supercomputing.[80] As discussed earlier in the section on interchangeability, a base of core customers with critical applications continue to see vector systems as the only feasible solution to some of their computing needs and has continued buying these computers.[81] At the high end, vector supercomputers remain very expensive (although prices have decreased), generally ranging in price from $2.5 million to $40 million or more.[82] At the low end, vector-system prices (which range from about $300,000 to $1 million)[83] are beginning to reflect the heavy competition with scalable systems, resulting in lower margins. Although that shift is not likely to drive the remaining vector firms out of the market, it signals a new era where supercomputer makers cannot necessarily rely on their products' elite status to ensure high prices. However, CRI maintains that customers with large computational requirements that require vector performance are willing to pay a "vector premium" to get it.

Scalable parallel systems, which emerged at the low end of the supercomputer market, recently have gained market share at the expense of vector supercomputers. To attract more high-end business, scalable-systems vendors have focused on selling systems with larger numbers of processors (such larger systems carry higher price tags as well). Prices for these systems range from less than $100,000 at the low end to hundreds of millions of dollars at the high end. In addition, scalable systems have evolved from their status as experimental computers and moved firmly into the marketplace.[84]

CRI argued at the hearing and in its posthearing brief that the price of vector supercomputers is typically higher than that of MPP or SMP systems with an equivalent peak performance. Also, according to a market survey conducted for CRI, certain purchasers are willing to pay a "vector premium" to obtain a vector supercomputer.[85] Fujitsu disagreed with the petitioner's survey findings and the manner in which the survey was conducted. Fujitsu further argued that there is a complete overlap in prices between vector and non-vector systems based on responses to the Commission's questionnaires.[86] NEC agreed with Fujitsu and added that high-end non-vector supercomputers were actually more expensive than high-end vector supercomputers.[87] On a cost/price performance basis, prices for vector supercomputer systems ranged from *** to ***, prices for MPPs ranged from *** to ***, and prices for SMP/SPPs ranged from *** to ***.

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[80] The Smaby Group, World Wide Web, http://www.smaby.com/hpcsummary.html, Aug. 7, 1997

[81] In its prehearing brief (pp. 20-22 and exh. 8) and its posthearing brief (p. 4 and Responses to the Commission's Questions, p. 12) Fujitsu provided examples of users of vector systems switching to non-vector systems.

[82] See app. D.

[83] Ibid.

[84] Hans W. Meuer and Erich Strohmaier, "1996: The Industrial Usage of HPC Systems Takes Off," *Primeur*, Nov. 18, 1996, and Jack Dongarra, et. al., "Changing Technologies of HPC."

[85] Hearing transcript, p. 50 and CRI's posthearing brief, pp. 6 and 9, and exhs. 1.A and 1.B (the whole IDC study) to Answers to Commission Question #1. Also see CRI's prehearing brief, pp. 30-31.

[86] Fujitsu's posthearing brief, pp. 3-4, and Responses to Commission's Questions, pp. 13-15, and Fujitsu's prehearing brief, pp. 28-30, 51-54, and 84.

[87] Hearing transcript, p. 106; NEC's prehearing brief, p. 40 and exh. 15, and NEC's posthearing brief, p. 5.

PART II: CONDITIONS OF COMPETITION IN THE U.S. MARKET[1]

MARKET SEGMENTS

The industry that produces supercomputers is global in scope and includes firms such as DEC, Fujitsu, Hitachi, HP/Convex, IBM, Intel, NEC, SGI/CRI, Sun, and TMC. The industry that produces vector supercomputers is also global in scope, but comprised of only a small number of large firms (SGI/CRI, Fujitsu, Hitachi, and NEC). The largest market for all supercomputers, especially the most powerful, is still the research market, much of which is funded by the government.[2] This market accounts for one-third to one-half of the total, but it is not growing. In fact, this market segment is projected to slowly decline in size. Because of this, supercomputer manufacturers have sought to increase their sales to private industry. Traditionally, automotive, aerospace, and energy-related firms have been a steady customer base.[3] As business has become more data intensive, a greater number of companies have turned to high-performance computing to track their costs and enhance their products. Currently, industrial customers account for roughly 30 percent of the supercomputer market. The remainder of the market is largely academic and research institutions.[4] Figure II-1 presents CRI's 1996 customer base for its vector supercomputers.

Figure II-1
CRI's sales of vector supercomputers, by industry, 1996

* * * * * * *

The U.S. market for supercomputers is segmented by "Buy American" restrictions and preferences. The tabulation below shows the contract value (in millions of dollars) of CRI's U.S. sales and/or leases of vector supercomputer systems that were subject to "Buy American" restrictions during January 1994-March 1997:[5]

	1994	1995	1996	Jan.-Mar. 1997
Sales and leases of vector supercomputer systems subject to "Buy American" restrictions.....	*	*	*	* * * *

Source: CRI's producer questionnaire response.

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[1] The COMPAS model has not been used to analyze the effect of imports on domestic firms' revenues for vector supercomputer systems. This is because the ability of both buyers and sellers to influence the price through their behavior contradicts the competitive assumptions of the COMPAS model. In addition, the COMPAS model would be less applicable because of the lack of comparable price data and the separation between the timing of the transactions and the payments.

[2] The largest market for mid-range vector supercomputers is universities.

[3] ***.

[4] Benchmark Programs and Reports, World Wide Web, http://www.netlib.org/benchmark, June 19, 1997. In the United States nearly all supercomputers on the current top 500 list that are used in academic institutions are non-vector.

[5] ***.

U.S. supercomputer sales that are subject to "Buy American" restrictions primarily consist of sales that are funded by the DOD[6] and/or classified government sales. On the basis of the data in table VI-2, the figures in the above tabulation represent the following shares of CRI's total revenue from its U.S. operations on vector supercomputers: ***.

SUPPLY AND DEMAND CONSIDERATIONS

U.S. Supply

The responsiveness of the supply of vector supercomputers to changes in price is influenced by such factors as the level of excess production capacity in the industry, the availability of export markets, the ease of shifting employees, facilities, and equipment to the production of other products, and the existence of significant inventories. The supply responsiveness of all supercomputers to changes in price is influenced by the same factors. The fact that the U.S. producer of vector supercomputers (CRI) has relatively large levels of excess production capacity, readily available export markets, significant inventories, and some ability to shift production between vector and non-vector supercomputers implies that it can quickly react to changes in the U.S. price for supercomputers. Should the Commission decide to broaden its like product definition to include all supercomputers, it is unclear how this would affect the domestic industry's supply responsiveness. Producers of all supercomputers have higher capacity utilization rates and exports/total shipments ratios, and fewer opportunities to switch production, which would imply that the domestic industry would be less able to respond to U.S. price changes. However, producers of all supercomputers also have higher inventory/total shipments ratios, which would suggest that the domestic industry could more readily respond to U.S. price changes.

Capacity in the U.S. Industry

Reported capacity data for the vector supercomputer industry indicate that there are ***. Capacity utilization rates reported by U.S. producers ranged from *** percent to *** percent during the years 1994-96. Capacity utilization *** to *** percent in interim 1997.[7] CRI's capacity to produce vector supercomputer systems ***.

Available data for the total supercomputer market indicates that there is some unused capacity, however, not as much as in the vector supercomputer market.[8] Capacity utilization rates for producers of all supercomputers ranged from *** to *** percent in 1994-96 and between *** and *** percent in the interim periods. U.S. producers' capacity to produce supercomputers *** systems in interim 1997. These data indicate that U.S. supercomputer producers can increase production in response to price increases in the U.S. market.

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[6] The Sabo amendment requires that any DOD-funded purchases of vector supercomputers be subject to "Buy American" restrictions. See P.L. 104-61 § 8103 (1995); 48 CFR § 225.7023-1 (1996).

[7] For additional information on the capacity in the U.S. industry, see the section in part III entitled "U.S. Capacity, Production, and Capacity Utilization."

[8] Data on the total supercomputer market is presented in app. C, table C-5, pp. C-11-C-12.

Production Alternatives

***. CRI reported that ***.[9] Convex reported in the preliminary phase of the investigation that ***.[10]

If the like product definition is broadened, U.S. producers would have fewer alternative production possibilities, since shifting production to non-vector supercomputer systems would no longer be considered a shift to production of an alternative product.

Inventory Levels

Available data indicate that U.S. producers have ***.[11]

As in the case of vector supercomputers, U.S. producers of all supercomputers have some ability to use inventories as a means of increasing the supply of supercomputers. Available data indicate that inventories of U.S. supercomputer producers ranged from ***.

Export Markets

CRI is a major supplier of vector supercomputers to export markets worldwide. CRI has traditionally supplied many supercomputers used by researchers around the world.[12] Exports have consistently accounted for ***. Exports of vector supercomputers accounted for between *** percent of CRI's total shipments (on a quantity basis) in 1994-96 and were *** percent in the interim period of 1997. Therefore, based on the available data, U.S. producers have the ability to divert shipments to or from the U.S. market in response to price changes.[13]

Data from U.S. producers of all supercomputers indicate that exports have been a significant outlet for U.S.-produced supercomputers. During 1994-96, U.S. exports of supercomputers accounted for between *** percent of U.S. producers' total shipments of supercomputers. Exports were slightly lower in the interim periods (i.e., *** percent), however, they were still at significant levels. As is the case with vector supercomputers, these data indicate that U.S. supercomputer producers have the ability to divert shipments to or from the U.S. market in response to price changes.[14]

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[9] CRI's questionnaire response, p. 4. However, CRI argues in its prehearing brief (pp. 28-30) and in its posthearing brief (pp. 7-8) that it maintains production lines and processes for its vector and non-vector products that are largely separate.

[10] Convex's preliminary questionnaire response. ***; posthearing brief, exh. I.D, Answers to Commission Question #1.

[11] For a discussion of inventories maintained by CRI, see the section in part III entitled "U.S. Producers' Inventories."

[12] Approximately 80 percent of the world's supercomputer-based environmental research sites use CRI systems (WorldWideWeb, http://www.cray.com).

[13] The ability to divert shipments to or from the U.S. market may be constrained by the fact that sales of supercomputers are done through a bid process that can, in some cases, take more than a year to complete.

[14] As noted in the discussion on exports of vector supercomputers, the ability to divert shipments may be constrained by the fact that sales are done through an often lengthy bid process.

U.S. Demand

U.S. supercomputer producers and importers were asked if demand in the United States had changed since 1994 and, if so, what the principal factors were that affected changes in demand. Questionnaire responses indicate that demand for vector supercomputers has decreased since 1994. CRI responded that demand for vector supercomputers has ***. Citing IDC's "High-Performance Technical Computing Market, Review, and Forecast,"[15] CRI shows the following data for 1994-2000:

Worldwide Yearly Revenues ($ Millions)

System Type	1994	1995	1996	1997	1998	1999	2000
Vector	*	*	*	*	*	*	*
Parallel processor	*	*	*	*	*	*	*

Source: Petitioner's posthearing brief, exh. 7.

***.

SGI responded that demand for vector and non-vector high-performance computer systems ***. IBM, a non-vector producer, responded that demand for ***. Intel noted that ***. Convex responded in the preliminary phase of the investigation that ***. Convex continued that ***.

HNSX agreed with SGI, IBM, and Convex that there has been a shift in the HPC market towards RISC-based systems. In its questionnaire response, HNSX maintained that:

> "Demand for high-performance computing systems has increased significantly since 1994. IDC estimates that 1996 global market for HPC was over $3 billion compared to its estimate for 1994 of $2.16 billion. While demand for HPC has increased, the composition of that demand has changed in three important respects. First, there has been a major shift in end-use demand from government agencies toward commercial users. Second, there has been a shift toward SMP and MPP architectures to meet their HPC needs. Third, composition of demand has shifted toward small- and medium-sized machines (e.g., SGI Power Challenge and Origin series, IBM SP series, HP 9000 series servers, Cray J series and smaller configurations of the NEC SX-4, Fujitsu VPP, and Cray T3E) and away from very large machines. The increase in demand at the commercial level is the result of many factors. These include the historical and continuous decline in price of computing power, the general availability of multi-platform software, the intense competition among vendors of various architectures, and the development of new end-uses such as data mining. While demand has increased since 1994, the increase has not been continuous. In particular, the delay in availability of larger models of the Cray T90 series shifted demand forward as customers waited for shipment of the new product."

Fujitsu characterized demand in the United States as ***.

Most responding purchasers reported that demand for supercomputer systems has shifted from large, expensive supercomputer systems to smaller, less expensive, more distributed "mid-range" supercomputer systems. Purchasers cited factors such as the increased performance of less expensive

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[15] ***. Fujitsu's posthearing brief, p. 3.

RISC-based systems, the increased porting of applications and algorithms to run on non-vector architectures, reduced government purchases, the ease of use of smaller mid-range and non-vector systems, and the lack of significant performance breakthroughs in vector technologies since 1994.[16]

Substitute Products

The vast majority of this section focuses on the extent to which vector and non-vector supercomputer systems are substitutable. In general, purchasers of supercomputers are applications driven, meaning that they will purchase the supercomputer system that runs their specific applications the most efficiently for the budgeted system price. The available evidence indicates that substitute products exist for vector supercomputer systems, which implies that U.S. purchasers of vector supercomputers have some ability to respond to changes in the U.S. price of vector supercomputers. If the Commission were to broaden the like product definition to include non-vector supercomputer systems, the demand responsiveness is likely to be reduced, since purchasers would no longer be able to substitute non-vector supercomputer systems for the like product.

Vector and Non-vector Supercomputer System Substitution

All parties agreed that there is a core base of customers for whom vector supercomputer systems are the only feasible solution to their computing needs.[17] The parties disagreed as to the size of this core base, and the extent of competition between vector and non-vector supercomputer systems in the rest of the market. The available evidence indicates that (1) mid-range vector and non-vector supercomputers compete directly, (2) vector and non-vector supercomputers are used in a large number of the same end-use categories, and (3) both vector and non-vector supercomputers can run and are running on the majority of third-party applications. The available evidence concerning the ability of vector and non-vector supercomputer systems to run proprietary "in-house" codes efficiently is more mixed.

Parties' arguments

Fujitsu claimed in its questionnaire response that ***. HNSX responded in its questionnaire that the vast majority of applications and end uses allow for vector or non-vector architectures, although some small niches remain. In most cases, financial constraints of a purchase (or lease) result in the selection of the system offering the best solution for customer-specific applications regardless of architecture. MPP systems, with or without vector capabilities, have been and are being substituted for vector supercomputers. There is clear evidence that traditional vector niches of the 1980s, such as weather forecasting, climate research, seismic processing, large-scale engineering including automotive and aerospace, and data center service, are today divided among SMP and MPP, as well as vector systems.

CRI responded that ***.

SGI reported that ***. IBM, a non-vector supercomputer producer, responded that ***. Intel responded that ***. For a more detailed discussion of the characteristics of vector supercomputers and other high-performance platforms, see the earlier section of this report entitled "The Product."

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[16] ***.

[17] CRI's posthearing brief, Answer to Commission Question #1, pp. 1-3, exh 1-A, 1-C, 1-D, 1-E, and #7, pp. 5-6. NEC's posthearing brief, pp. 16 and 25. Fujitsu's posthearing brief, pp. 3-4, 19-20. Also see, meeting with ***, Sept. 8, 1997. Teleconference with ***.

Competition in the mid-range segment

The available evidence indicates that mid-range vector supercomputers (e.g., CRI J90) and mid-range non-vector supercomputers (e.g., SGI Origin 2000, DEC Alpha Server 8400, HP/Convex Exemplar) compete directly. ***.[18] ***.[19] SGI's Power Challenge product guide states "In addition, {Power Challenge's} coherent shared memory model allows applications to be easily ported from vector type supercomputers, then optimized and parallelized for peak performance."[20] IDC includes CRI's J90s with DEC Alpha Server 8400's, SGI Power Challenges, and other non-vector machines in its high-performance mid-range category.[21] NEC provided nine examples of supercomputer sites that have switched from vector to mid-range non-vector architectures.[22]

* * * * * * *.[23]

	1994	1995	1996
T90s.....		* * * * * * *	
J90s.....		* * * * * * *	

End-use categories

The available evidence indicates that vector and non-vector supercomputers are used in a large number of the same end-use categories. U.S. producers and importers were asked to identify, for each model of supercomputer they supplied during January 1994-June 1997, the applications or end uses for which their models are currently employed. U.S. producers and importers were given a choice of 20 different end-use/application categories to assign to each model they supplied.[24] U.S. producer and importer responses to this question are presented in table E-1 in appendix E. Based on these responses, both vector and non-vector supercomputers are currently employed in 15 of the 20 end-use/application categories. U.S. purchasers were asked to identify, for each model of supercomputer they purchased during January 1994-June 1997, the applications or end uses for which each model they purchased are currently employed. U.S. purchasers were given a choice of the same 20 end-use/application categories to assign to each model they purchased. Purchaser responses to this question are presented in table E-2 in appendix E. Based on these responses, both vector and non-vector supercomputers are currently employed

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[18] ***.

[19] ***.

[20] NEC's prehearing brief, p. 21.

[21] Hearing transcript, pp. 146-147.

[22] NEC's prehearing brief, exh. 8.

[23] ***.

[24] The end-use/application categories are: structural analysis; structural design; piping analysis; electrical engineering and electromagnetics; nuclear engineering and energy; computational fluid dynamics; reservoir simulation; seismology; other petroleum; chemical engineering, chemistry, and biotechnology; general purpose engineering; visualization, graphics, and imaging; mathematics, econometrics, and statistics; languages and information management; environmental sciences; on-line transaction processing; database management systems; data warehousing and data mining; decision support systems; and manufacturing and industrial process analysis.

in 14 of the 20 end-use/application categories. IDC's market study reported that both vector and non-vector supercomputer systems were used in the aerospace, automotive, chemical, defense, oil, research, and university market segments.[25] However, in its questionnaire response, CRI maintains ***.

Third-party applications

The available evidence indicates that both vector and non-vector supercomputers can run and are running on the majority of third-party applications. A TRC-prepared study shows that 82 percent of the third-party applications running on CRI vector supercomputers can also run on non-vector platforms.[26] NEC supplied a list of 61 third-party applications accounting for 90 percent of total supercomputer cycles using commercially available or public domain software. This list indicates that all 61 applications are running in parallel on both vector and non-vector architectures.[27] NEC also provided a list showing 67 examples of third-party supercomputer applications running on both vector and non-vector architectures at the top 500 and other supercomputer sites.[28]

CRI acknowledges that virtually all codes that run on a vector system can, as a technical matter, be run on other platforms. However, CRI argues that many key vector applications do not run effectively on MPP, SMP, or other systems (e.g., because certain codes require a single processor capability[29] that is only available on vector platforms).[30] ***.[31] ***.[32] ***.[33] According to the GAUSSIAN home page on the World Wide Web, GAUSSIAN 94 can execute in parallel on shared memory multiproccessors and can also run in parallel across the separate CPU's in a distributed memory multiprocessor.[34] CRI also provided a

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[25] CRI's posthearing brief, exh. 1.B.

[26] Three hundred eighty-three of the 577 applications listed on the CRI website were identified as running on vector supercomputers. TRC cited evidence that indicated that 313 of these applications, or 82 percent, also run on non-vector platforms. The sources used by TRC to determine which platforms were running the various applications on the CRI list were: (1) software vendor documentation, (2) hardware vendor documentation, (3) supercomputer site documentation, and (4) anecdotal information contained in press releases, press accounts, the academic literature, etc. Staff met with TRC representatives on Sept. 5, 1997, and examined samples of the study's documentation. The applications list compiled by end use demonstrates that a high degree of substitutability occurs in each of the end-use applications identified by CRI. For example, the percentage of applications run on vector supercomputers that also run on non-vector systems ranges from 56 percent in seismology to over 90 percent for mathematics, econometrics and statistics; electronics and electromagnetics; and chemistry and chemical engineering; attachment 8, exh. 1 of NEC's prehearing brief.

[27] The "Most Widely Used Supercomputer Applications" list was prepared by John Levesque, president of Applied Parallel Research, Inc. The list cites end-user web sites as information sources. Exh. 1, attachment 9 of NEC's prehearing brief.

[28] NEC's prehearing brief, exh. 7.

[29] ***.

[30] CRI's posthearing brief, pp. 6-7.

[31] CRI's posthearing brief, exh. C. ***.

[32] ***.

[33] ***.

[34] GAUSSIAN 94, World Wide Web, http://www.gaussian.com/g94_perf.htm, Feb. 27, 1997.

list of 22 applications that it characterizes as essential for the CRI T90.[35] Seventeen of these applications are included in NEC's listing of 67 examples of third-party supercomputer applications running on both vector and non-vector architectures.[36]

Proprietary "in-house" applications

The available evidence concerning the ability of vector and non-vector supercomputer systems to run proprietary "in-house" codes efficiently is more mixed. CRI argues that proprietary "in-house" codes that, according to IDC, constitute *** percent of the applications run on vector systems cannot be "transported" to non-vector platforms without a considerable commitment of time and resources.[37] NEC maintains that applications that are not currently run on non-vector supercomputers were typically developed a number of years ago by public sector users when vector systems were the most powerful supercomputers available. Dr. Levesque, President of Applied Parallel Research Inc., states that "As a result of developing conversion techniques, virtually all vector supercomputer applications are compatible with non-vector supercomputer use."[38] Dr. Mohr, Chief Scientist for Information Technology Solutions, states that these applications are presently a diminishing fraction of public sector supercomputing, and that the majority of government applications have been adapted to non-vector architectures through a series of comprehensive government programs designed to develop codes that would run on non-vector architectures.[39]

Purchasers were asked if the software applications that they have developed in-house are usually developed for a particular (i.e., vector or non-vector) architecture. Purchasers were also asked whether their in-house software applications written for a vector supercomputer can be transferred easily and quickly to a non-vector supercomputer (and vice-versa), and what is the cost in terms of work-years that would be required to move major software applications from a vector to a non-vector system. ***.[40]

Eleven of 17 responding purchasers reported that the differences between the architecture of a vector supercomputer and other types of supercomputers lead to differences in the ability of the supercomputers to address different sets of problems. Most purchasers cited the degree of parallelism of the data as determining whether the application will run better on a vector or a non-vector system. Thirteen of 15 responding purchasers reported that there are types of applications that can use either vector or non-vector supercomputer systems. However, most of the purchasers indicated that performance on the application will vary, depending on the application, the supercomputer architecture, the nature of the data, the optimization of the data, and other factors.

Other substitute products

Purchasers were also asked if there are other products or services, such as purchasing time from supercomputer centers, using otherwise idle networked workstations, or other services which can serve to some extent as a substitute for their purchase or lease of a vector supercomputer. Four purchasers reported

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[35] ***; CRI's posthearing brief, exh. 1.B.

[36] ***.

[37] CRI's posthearing brief, pp. 6-7.

[38] NEC's posthearing brief, exh. 1.

[39] NEC's prehearing brief, p. 22.

[40] ***.

purchasing time from supercomputer centers[41] and six purchasers reported being able to do some of their vector supercomputer applications on workstations.[42]

Comparison of Domestic Products and Subject Imports

Vector supercomputer systems are often highly differentiated products. Specifications of competing U.S.-produced and imported Japanese vector supercomputer bids can differ substantially with respect to important characteristics such as sustained performance of the most important benchmarks; processor and memory technology (e.g., CMOS or ECL); main memory size; maximum main memory bandwidth; maximum I/O bandwidth; cooling systems required; and other important features. For example, ***,[43] ***.[44] ***.[45]

The substitutability of U.S.-produced and imported Japanese vector supercomputers is further limited by the fact that *** of the U.S. market are closed to the Japanese suppliers because of "Buy American" restrictions. Competition between U.S.-produced and imported Japanese vector supercomputers may also be limited by the existence of "Buy American" preferences in the U.S. market. For a detailed discussion of "Buy American" restrictions and preferences in the U.S. vector supercomputer market, see the earlier part of this section entitled "Market Segments."

Substitutability between U.S.-produced and imported Japanese supercomputers also depends on factors such as compatibility of replacement or additional vector supercomputer systems with existing supercomputer systems,[46] the financial strength and stability of the competing suppliers, and the technical risk involved with offers of new generation computer architectures that are unavailable for actual LTDs.

Purchasers were asked to comment on the differentiation between domestic and Japanese supercomputers. Of the 31 purchasers that responded to the Commission's questionnaire, only a few provided comments.[47] Because the number of responses was small, it is difficult to make generalizations regarding the overall product differentiation between U.S. and Japanese supercomputers. However, nine firms did report some differences between the domestic and Japanese products; comments of these firms are presented below.

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[41] ***.

[42] ***.

[43] Competing vector supercomputer equipment is typically tested on a benchmark suite of programs to determine its performance capability and capacity. Often, one supplier's equipment will outperform the other supplier's equipment on some of the benchmark tests, but will underperform on the other benchmark tests. In these cases, the purchaser must decide which benchmarks are the most important, and weigh the differing performance results. For this reason, a purchaser's performance evaluation generally involves more than a simple comparison of overall peak performance rates.

[44] For a more detailed discussion of the UCAR project, see part V of this report.

[45] See table V-5.

[46] The fact that a large number of bids for vector supercomputers were single sourced suggests that compatibility of new equipment with existing equipment may be a significant factor. Purchasers sole source through either a direct, non-competitive procurement, or by a specification which defines a specific product.

[47] Purchasers were asked to discuss the extent to which U.S.-produced and imported Japanese supercomputer systems are differentiated by factors other than type of technology (i.e., delivery times, reliability, service, compatibility with existing systems, stability of supplier, etc.).

Firm	Comments on product comparisons
*	* * * * * *

Based on this limited number of responses, it appears that purchasers have found some differences between U.S.-produced and Japanese supercomputers.

If the like product definition were to be broadened to include non-vector supercomputer systems it is likely that the substitutability between the U.S. and imported products would be reduced. The U.S. imported very few Japanese non-vector supercomputer systems during the period of investigation. If the substitutability between U.S.-produced and imported Japanese vector supercomputer systems is greater than the substitutability between U.S. produced non-vector supercomputer systems and imported Japanese vector supercomputer systems, this would suggest that substitutability between U.S. and imported Japanese supercomputers would be less than that between U.S. and imported Japanese vector supercomputers.

Comparison of Domestic Products and Subject Imports to Nonsubject Imports

Available evidence indicates that there were very few imports of nonsubject products during January 1994-June 1997. U.S. importers reported imports of *** MPPs since 1994 . Meiko, a British manufacturer, sold two MPPs to LLNL; they were installed in 1994. NEC reported that it has imported *** [48]

[48] For a more detailed description of nonsubject imports, see the section of this report entitled "U.S. Imports, Apparent Consumption, and Market Shares."

PART III: CONDITION OF THE U.S. INDUSTRY

The Commission analyzes a number of factors in making injury determinations (see 19 U.S.C. §§ 1677(7)(B) and 1677(7)(C)). Information on the final margins of dumping was presented earlier in this report and information on the volume and pricing of imports of the subject merchandise is presented in parts IV and V. Information on the other factors specified is presented in this section and/or part VI and (except as noted) is based on the questionnaire response of CRI.[1]

U.S. PRODUCERS

There were two producers of vector supercomputers in the United States during January 1994-June 1997: the petitioner, CRI, Inc., Eagan, MN,[2] and Convex, Richardson, TX. CRI, founded in 1972 by Seymour Cray, has been the dominant U.S. producer of vector supercomputers,[3] accounting for an estimated *** percent of total U.S. supercomputer factory revenue in 1996,[4] and is currently essentially the only remaining U.S. producer of such supercomputers.[5] In 1985, Seymour Cray and his team started work on the Cray-3, which suffered delays due in part to the use of advanced technology. In November 1989, CRI's management decided it could no longer pursue both the C90 and the Cray-3 projects. To prevent closing down Seymour Cray's project, the development of the Cray-3 was spun off into a new company

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[1] Convex could not provide the data as requested by the Commission during the preliminary phase of the investigation although it did provide responses to the narrative questions. ***; telephone conversation, July 15, 1997. ***.

The quantities presented in this section are based on systems and Gflops although discussion in the text is limited to systems. *** provided data on MPPs; such data are presented in app. C. ***. ***.

[2] CRI maintains three business units: Software Development and Applications for Supercomputing Systems, Eagan, MN; Software Engineering and Technical Marketing for Business Systems, San Diego, CA, and Beaverton, OR, respectively; and Research Engineering, Development, and Manufacturing, Chippewa Falls, WI, Beaverton, and San Diego.

[3] CRI/SGI also produces MPPs (T3D and T3E series, and the YMP series), SPPs (the Origin 2000), and SMPs (according to their bid data). The majority of SGI/CRI's sales listed in the Top500 Supercomputer Sites are the T3 series, the YMP series, and the Origin 2000.

[4] Total U.S. factory revenue of *** for supercomputers was obtained from Commerce, 1996 Dataquest Inc. Dataquest defines supercomputers as high-performance computers designed for numerically intensive applications with prices ranging from approximately $100,000 to $20 million.

[5] CRI is the worldwide revenue leader in the high-end supercomputing markets, with a 1994 market share of more than 70 percent, according to the Smaby Group, a Minneapolis-based research firm that tracks high-performance computing; CRI's questionnaire response, CRI News, "Cray Research Redefines Scalable Computing with Cray T3E System, World's First Truly Scalable Supercomputer." In a recent market study, IDC reported that CRI held *** percent of worldwide supercomputer shipments in 1995, and had *** percent of the worldwide supercomputer revenue in 1996 (based on a preliminary estimate of ***); ***.

called Cray Computer Corp. However, CCC was unable to overcome technological[6] and packaging problems, and in 1995 CCC sought protection under Chapter 11 and closed the business.[7]

CRI has the largest share of the world market for large-scale vector supercomputer systems used in government,[8] industry, and academia.[9] As of July 1, 1996, CRI became a wholly owned subsidiary of SGI,[10] together becoming perhaps the world's leading high-performance computer company.[11] CRI was the first U.S. company to offer parallel Unix processing in the supercomputing environment.[12] CRI's vector pipelining provides a way to perform the same operation on a large array of numbers very quickly.[13]

On December 20, 1995, HP announced its acquisition of Convex, which is now a wholly owned subsidiary of HP, known as the Convex Technology Center of HP.[14] As a result of the acquisition, HP now

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[6] CCC decided that in order to produce fast chips they would be based on gallium arsenide, a material with faster switching times than silicon. This decision led, in part, to exceptionally high manufacturing overhead to be spread over a dozen or so units.

[7] CCC did make a tentative sale to LLNL in 1991, but when it was unable to meet delivery and performance goals, the order was canceled.

[8] Sales to U.S. government agencies and commercial customers primarily serving the U.S. government constitute a significant, but declining, portion of CRI's business. Today, commercial customers make up 30 percent of CRI's customer base and with its broadened product line, CRI expects the commercial market to grow to 40 percent of its customer base in the next year or two: CRI News, "Cray Research Announces Latest Advance in "Commercial-Strength" UNIX Software."

[9] In 1991, CRI entered the growing market for mid-range scientific and technical supercomputers. With the introduction of the Cray Superserver 6400 series in 1993 (which it no longer produces), CRI entered the commercial market, with customers in financial services, telecommunications, transportation, and manufacturing industries.

[10] SGI, Mountain View, CA, is the parent company to a number of divisions, including CRI in Eagan, MN, and SSG in Mountain View. ***. ***; SGI's questionnaire response. SGI, which started production a number of years after CRI, ***. SGI concentrated on specialized graphics workstations and is now a leading manufacturer of high-performance and commercial computing systems. It sells interactive three-dimensional graphics, digital media, and SMP technologies to technical and commercial environments. Its subsidiary, MIPS, designs and licenses the RISC processor technology for the computer systems. ***. ***; CRI's questionnaire response. ***; petitioner's postconference brief, p. 17. See also the news releases attached to CRI's questionnaire response received June 19, 1997. ***.

[11] The Top500 Supercomputer Sites, June 1997, shows that SGI/CRI had a combined total of 204 systems installed, by far the largest number of the companies listed. IBM was the next largest with 70 systems installed; World Wide Web, http://www.netlib.org/benchmark/top500.html..

[12] CRI's UNICOS is considered the most mature Unix-based supercomputer operating system.

[13] CRI has moved into new high-performance architectures with the T3E and T3D supercomputers.

[14] HP produces high-performance, Unix-based computer systems, such as SPPs, supercomputer-class systems, etc.

provides support for the Convex C series[15] and Exemplar[16] scalable parallel processor product lines.[17] The Convex C Series of vector parallel supercomputers had offered innovative supercomputing solutions to customers since the 1980s.[18] Convex markets its products primarily to manufacturing (automotive, aerospace, and construction), government/defense, chemistry, petroleum, university/research, environmental, and financial and commercial users for a wide range of applications, including data management. During 1995, Convex reduced its participation in the vector supercomputer market and it ***.[19] A third company, Tera, Seattle, WA, has been designing a shared-memory vector-like multiprocessor.[20] The system will be able to accommodate up to 256 processors and a limited number of systems and was expected to be available in the second half of 1996 or the beginning of 1997.[21]

In addition, there are several firms in the United States that produce and sell MPP and SMP/SPP supercomputers.[22] IBM is one of the main competitors to CRI in the production and sale of these other supercomputer systems.[23] IBM was recently selected by the LLNL, Livermore, CA, for a $93 million contract to build the world's fastest supercomputer. The IBM RS/6000 Scalable POWER parallel (SP) systems will be installed as part of the ASCI programs[24] designed to deliver tera-scale computing

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[15] The C4600 series, which is a shared-memory multi-vector processor, is the fourth generation of vector processors from Convex.

[16] The Exemplar product line, a RISC-based, distributed-memory multiprocessor, was introduced in March 1994. The HP/Convex Exemplar SPP-2000 has an "application compiler" available that is capable of interprocedural analysis that can greatly enhance the vectorisability of some codes.

[17] ***.

[18] Convex recently introduced its Exemplar series, SPP architecture that groups HP's PA-RISC 7200 processors into powerful computing nodes. ***.

[19] Since Convex no longer actively produces or sells vector supercomputers, ***.

[20] The architecture is scalable and general purpose, meaning that users can easily add processing power without reprogramming.

[21] ***; letter from James Rottsolk, President, June 30, 1997.

[22] The Commission sent producers' questionnaires to *** firms not identified in the petition which were believed to produce supercomputers other than vector supercomputers. These firms were ***. *** of these firms responded to the questionnaire; *** provided data and ***; telephone conversation, June 3, 1997. The Commission was unable to obtain usable responses from 4 of these firms.

[23] IBM has several supercomputing platforms, including the S/390 ES/9000 with vector facilities, the POWER visualization system, the RISC system/6000, and the recently introduced scalable POWER parallel systems. The IBM Power2 is a new microprocessor with CMOS technology. In its questionnaire response, IBM stated that ***; telephone conversation, July 16, 1997. IBM provided a correction to its questionnaire on July 24, 1997, which included a means for converting nodes to systems as follows: ***.

[24] The ASCI program, which was started to ensure that the United States would stay at the forefront of developing HPCs, involves three major DOE facilities (Livermore, Los Alamos, and Sandia National Laboratories), which over the next 5 years will study a variety of complex problems, among them ensuring the safety of the nation's nuclear stockpile. The Intel ASCI Option Red system was selected in Sept. 1995 as a teraflop supercomputer (9,000 Pentium Pro processors in 4,500 compute nodes) at Sandia. The Los Alamos facility will be supplied with *** supercomputers which should contain 3,072 MIPS R 10000 microprocessors by 1999. The ***. The ASCI program ***; petitioner's postconference brief, part II.

capability.[25] ***. Intel's SSD was formed in 1984 to commercialize large-scale parallel computer systems based on standard Intel microprocessors. Intel designs, develops, manufactures, and markets microprocessor components and related products at various levels of integration. Intel is a leading supplier of scalable high-performance computer systems, such as the high-performance Paragon supercomputer.[26] DEC produces and sells ***, which compete in the high-performance computer market.[27] DEC's software development tools for parallel applications include high-performance Fortran, parallel software environment, and DEC PVM. DEC ***. TMC produced MPP supercomputers during 1993-95, but filed for protection under Chapter 11 in 1994 and is now effectively out of the hardware business.[28] Sun is a supplier of network computing products, including workstations, servers, software, microprocessors, and a full range of services and support. Sun's products have a growing share of the networked workstations market.[29] Unisys produces SMP-type computers that can be scaled up with additional processors and clustered with other machines. Unisys high-end machines are competitive with similar high-end computers produced by Tandem, Siemens Pyramid, NCR, Sequent, Amdahl, etc.[30]

During the past few years the vector supercomputer industry has confronted a double-edged challenge--decreasing government spending in the post-cold war era and enormous improvements in commodity microprocessors. Traditional markets have stopped growing and comparatively low-cost, mass-produced computers have entered the high-performance computing arena. As a result of these forces, several supercomputer companies have closed; others have merged with larger, broader-based computer firms; and new entrants as well as old-line companies have developed more cost-effective solutions to penetrate new markets. The following tabulation presents the changing dynamics of U.S. producers of vector and non-vector supercomputers from 1969 to 1996:

Company	Dates of operation
Alliant	1982-92
American	1985-86
CCC	1989-95
Celerity	1983-88
Chopp	1975-88
Convex	1982-95 company merged
CRI	1972-96 company merged
Culler	1969-87
Cydrome	1984-88

[25] The IBM RS/6000 SP is a general-purpose SMP system based on MPP architecture; it can grow to accommodate as many as 512 processors to perform numeric-intensive and data-intensive tasks.

[26] Some of the major installations of Intel supercomputing systems are at Sandia National Laboratories, Oak Ridge National Laboratory, the San Diego Supercomputer Center, etc. ***; telephone conversation with ***, July 14, 1997, and Intel's questionnaire response.

[27] Meeting with ***. The DEC Alpha processors are microprocessors with CMOS technology. The Alpha Servers ***. DEC ***.

[28] ***. ***; telephone conversation with ***.

[29] As discussed earlier in the report, CRI sold ***.

[30] ***; telephone conversation July 2, 1997. ***.

ETA	1983-89
Evans & Sutherland	1989-89 exited hardware business
Floating Point	1970-91 company merged
Intel	1984-96 exited supercomputer business
KSR	1986-95
Key	1987-89
Multi-Flow	1984-91
Saxpy	1983-88
Scientific Computer	1983-89
TMC	1984-95 exited hardware business

New entrants into the high-performance computing market are not new to computing--they are some of the largest and best known companies in the computer industry. These firms, such as IBM and DEC, have broad production, research and development, and marketing bases in computer systems and components and have succeeded in blurring the line that divided supercomputers from the rest of the computer industry. In 1996 SGI, CRI, IBM, and DEC accounted for over two-thirds of the world market and an even higher percentage of the U.S. scientific/engineering/technical market.

U.S. CAPACITY, PRODUCTION, AND CAPACITY UTILIZATION

Table III-1, at the end of this section, presents data on CRI's capacity and production of vector supercomputers during January 1994-June 1997. Capacity to produce vector supercomputer systems *** between 1994 and 1995 and then *** to the level in 1994. Capacity *** in interim 1997. Production of vector supercomputers *** from 1994 to 1995, but then *** in 1996. Such production also *** in interim 1997. Capacity utilization levels were *** throughout the period and followed the same trends as capacity and production.

U.S. SHIPMENTS

CRI's shipments are presented in tables III-2 and III-3 at the end of this section. The volume of U.S. shipments *** between 1994 and 1995, and then *** in 1996. U.S. shipments *** in interim 1997. The value of U.S. shipments, however, *** between 1994 and 1995, and then *** in 1996, although to a level *** than that in 1994. The value of such shipments *** in interim 1997. The volume of exports *** as U.S. shipments during 1994-96 and interim 1997. The value of exports, however, *** throughout 1994-96 but then *** in interim 1997.

U.S. PRODUCERS' INVENTORIES

CRI noted in its preliminary questionnaire response that its vector supercomputer systems ***. CRI restructured its product line in 1995 to tap demand for new and innovative applications. This led to *** CRI had a large backlog of orders, the highest year-end backlog in its history.[31] Inventories in interim

[31] The increase in the backlog resulted from the high level of orders in 1995, the product transition to the T3E, and production constraints on the T90. The backlog was almost all for 1996 acceptances. The delivery schedule (continued...)

1997 were at the *** as full year 1996. The ratio of inventories to U.S. shipments was *** percent in 1994 and *** percent in 1996, although it reached *** percent in January-June 1996. This ratio *** percent in the corresponding period of 1997 (table III-4, at the end of this section).

U.S. EMPLOYMENT, COMPENSATION, AND PRODUCTIVITY

CRI's employment and productivity data are presented in table III-5 at the end of this section. Employment and hours worked *** during 1994-96 and interim 1997. Wages paid to PRWs *** between 1994 and 1995 and then *** in 1996 but to a level *** than in 1994. Hourly wages, however, were *** in 1996 than in 1994. Wages paid to PRWs and hourly wages *** in interim 1997.

Table III-1
Vector supercomputers: CRI's production capacity, production, and capacity utilization, 1994-96, Jan.-June 1996, and Jan.-June 1997

* * * * * * *

Table III-2
Vector supercomputers: CRI's shipments (by systems), by types, 1994-96, Jan.-June 1996, and Jan.-June 1997

* * * * * * *

Table III-3
Vector supercomputers: CRI's shipments (by gigaflops), by types, 1994-96, Jan.-June 1996, and Jan.-June 1997

* * * * * * *

Table III-4
Vector supercomputers: CRI's end-of-period inventories, 1994-96, Jan.-June 1996, and Jan.-June 1997

* * * * * * *

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[31] (...continued)
for the T90 systems and the T3E systems began in the second quarter of 1996. The orders for the T90 were worldwide, with automotive manufacturers such as Ford, Chrysler, Kia Motors, and many Japanese auto firms; Electronic Data Systems NTT; and national research centers and climate/weather organizations; Fujitsu's postconference brief, p. 36. As of Mar. 31, 1997, CRI's order backlog was *** and SGI/CRI's consolidated backlog on June 30, 1997, was $537 million; Fujitsu's prehearing brief, p. 37.

Table III-5
Vector supercomputers: Average number of PRWs, hours worked, wages paid to such PRWs, and hourly wages, productivity, and unit labor costs, 1994-96, Jan.-June 1996, and Jan.-June 1997

* * * * * * *

III-7

PART IV: U.S. IMPORTS, APPARENT CONSUMPTION, AND MARKET SHARES

U.S. IMPORTERS

Importers' questionnaires were sent to three firms that the Commission believes accounted for all imports of vector supercomputers from Japan[1] during January 1994-June 1997. The three firms reporting imports of vector supercomputers from Japan are Fujitsu, San Jose, CA; HNSX, Boxborough, MA; and NEC, Woodlands, TX. Fujitsu is a wholly owned subsidiary of Fujitsu Limited, Japan, and HNSX and NEC are wholly owned subsidiaries of NEC Corporation, Japan. Fujitsu began its supercomputer marketing efforts in the United States in 1992[2] and currently offers three basic systems, all of which are vector parallel processors that are scalable.[3] ***.[4] ***.[5] ***.[6] Fujitsu won an order for a vector supercomputer from Western Geophysical, a U.S. oil drilling research company in 1995, ***.[7] ***[8] ***.[9] ***[10] ***.[11]

U.S. IMPORTS

U.S. imports of vector supercomputers are presented in table IV-1 at the end of this section. Few vector supercomputers entered the United States during January 1994-June 1997. ***.

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[1] In its questionnaire response, Fujitsu reported that ***. Fujitsu America *** imported one *** system ***, for its customer, Japan's NAO, whose U.S. facility is located in Hawaii. ***. ***; see letter from Fujitsu's counsel, Aug. 1, 1997, for a more detailed explanation of this sale. ***. NEC reported that ***. Meiko, a British manufacturer, sold *** MPP computers to LLNL which were installed in 1994. The larger of the *** was upgraded in July 1996.

[2] Fujitsu employs more than 3,500 people in the United States in manufacturing, laboratories, software development, and sales.

[3] Conference transcript, p. 142.

[4] The sale in 1994 was to ***.

[5] ***.

[6] ***.

[7] ***.

[8] ***. HNSX supports SX-3 systems located at the Houston Advanced Research Center and at the Atmospheric Environmental Service in Dorval, Quebec. HARC's current research focuses on energy, biotechnology, and the environment. The AES systems are used for daily weather forecasting, severe weather and environmental disaster prediction, and climate modeling and research.

[9] ***.

[10] ***.

[11] ***.

IV-1

APPARENT U.S. CONSUMPTION

Data on apparent consumption of vector supercomputers are presented in table IV-2 at the end of this section. Apparent U.S. consumption is calculated from U.S. producers' and importers' shipment data provided in response to Commission questionnaires. The volume of U.S. consumption, by systems, *** from 1994 to 1995, but *** in 1996 ***. The volume of apparent consumption *** in interim 1997. The value of such consumption, however, *** from 1994 to 1995 and then *** in 1996.

U.S. MARKET SHARES

The market shares of U.S. producers and imports from Japan, based on apparent U.S. consumption of vector supercomputers, are presented in table IV-3 at the end of this section. The import market share, by systems, *** between 1994 and 1995 and then *** in 1996. Import market share, by quantity, *** in interim 1997. Import market share, by value, however, *** during 1994-96 and then *** in interim 1997.

Table IV-1
Vector supercomputers: U.S. imports from Japan, 1994-96, Jan.-June 1996, and Jan.-June 1997

* * * * * * *

Table IV-2
Vector supercomputers: U.S. shipments of domestic product, U.S. import shipments from Japan, and apparent U.S. consumption, 1994-96, Jan.-June 1996, and Jan.-June 1997

* * * * * * *

Table IV-3
Vector supercomputers: U.S. producers' and importers' market shares, by types, 1994-96, Jan.-June 1996, and Jan.-June 1997

* * * * * * *

PART V: PRICING AND RELATED DATA

FACTORS AFFECTING PRICING

U.S. Inland Transportation Costs

The U.S. inland freight component was not broken out separately by U.S. producers or importers in their reported cost figures. Although specific figures are not available, U.S. transportation costs to the purchaser reportedly average less than 1 percent of the delivered installed price of vector supercomputers.[1]

Commerce Margins of Dumping

On August 21, 1997, Commerce published notice of its final determination that vector supercomputers from Japan are being, or are likely to be, sold in the United States at LTFV. The final margins are as follows (in percent):

Japanese producer/exporter	LTFV margins
Fujitsu	173.08
NEC	454.00
All others	313.54

Commerce's period of investigation was July 1, 1995 through June 30, 1996. Since NEC decided not to participate in Commerce's investigation, Commerce determined that an adverse inference was appropriate. Based on this, Commerce assigned to NEC the margin stated in the petition, 454 percent. On May 20, 1997, Fujitsu submitted a letter stating that it would no longer participate in the Commerce's investigation. As a result of Fujitsu's decision to not complete its response to Commerce's supplemental questionnaire, Commerce applied facts otherwise available in its final determination. Commerce determined Fujitsu's margin by comparing export price with constructed value calculated in the petition. Since Commerce did not have the data necessary to calculate a weighted-average margin from the NEC and Fujitsu facts-available margins, Commerce calculated a simple average of these margins to apply as the "all others" rate.

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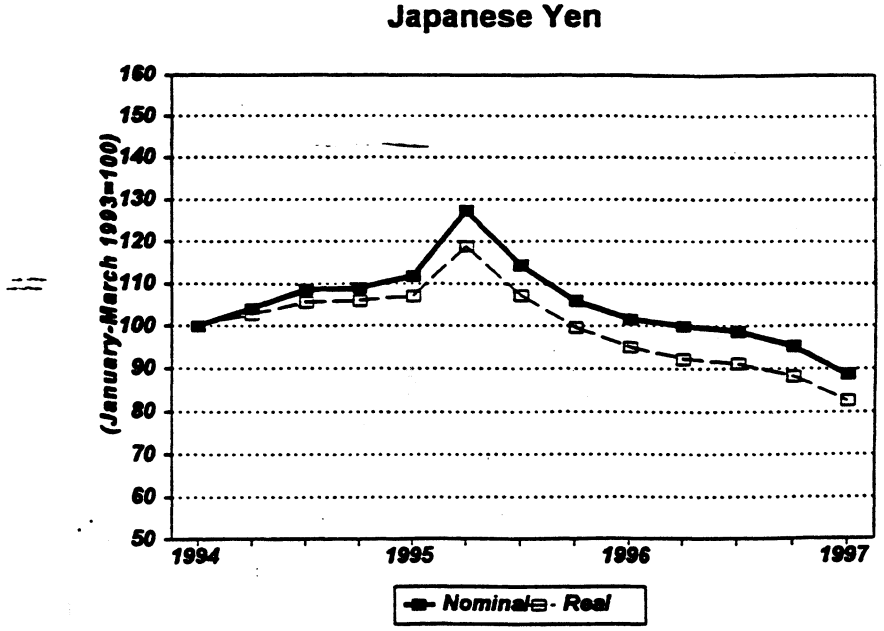
[1] ***.

Exchange Rates

Quarterly exchange rates reported by the International Monetary Fund for Japan during the period January 1994-March 1997 are shown in figure V-1.

Figure V-1
Exchange rates: Indexes of nominal and real exchange rates of the Japanese yen relative to the U.S. dollar, by quarters, Jan. 1994-Mar. 1997



Source: International Monetary Fund, *International Financial Statistics*, July 1997.

PRICING PRACTICES

Most vector supercomputers are either sold through a closed-bid procedure or are sole-sourced. For most closed bids the bidding firms usually know who they are competing against. The bid procedure typically includes a formal RFP. The RFP usually contains detailed specifications for the system(s) to be delivered (these specifications may include functional and/or performance requirements for hardware, software, the system as a whole, and support/maintenance); a delivery schedule; proposed terms and conditions; financial requirements or budget constraints; and proposal/bid-evaluation criteria.

The supplier reviews all elements of the RFP and prepares technical and business proposals in response to the requirements of the RFP. The key areas typically covered are technical requirements; hardware and software configurations; benchmark requirements; site conditions and preparation; installation
and testing of the systems; user training; service/support; terms and conditions; and pricing.

Bids are typically based on published list prices. List prices are based on market factors, price/performance levels, and comparison to costs. List prices are established at a level above manufacturing costs, and are intended to cover other expenses such as R&D, SG&A, and profits. Other

factors considered in determining the bid include trade-in of existing equipment; timing of deliveries; whether the product is at the beginning or end of its life cycle; gross margin projected for the transaction; current interest rates, expected residual value, and lease duration (when leases are involved); budget constraints of the purchaser; past volume of purchases by the customer; and size of volume in the subject bid opportunity. Some of these factors can result in discounts from list price.

The purchaser reviews the initial bids of participating suppliers and rejects unacceptable bids or asks certain suppliers to submit new bids. Competitive procurements that involve several million dollars almost always include some sort of LTD on the equipment being offered, or prototypes thereof. The LTDs are mandatory for all competitors, and generally involve the execution of a benchmark suite of programs provided by the purchaser that test the performance capabilities and capacities of the systems being offered. After the initial bid submissions, purchasers begin negotiations with the suppliers who have been deemed to be within the competitive range of offers. This process can take several months as purchasers try to decide which package offers the best value on the basis of performance, price, reputation, and service-related aspects. Negotiations conclude with the award of a sales contract, lease, or lease-to-purchase agreement, but delivery and installation can take from several months to 5 years after the contract is signed. Firms also purchase supercomputers on a non-competitive bid basis, either as upgrades to existing equipment, as stipulated by funding requirements, or for compatibility with existing equipment or other reasons.[2] In these cases, purchasers still need to develop specifications, which may be done with the supplying manufacturer. Purchasers may also negotiate with the supplying manufacturer to reduce the price of their purchase or increase the amount of equipment being offered. Purchasers buying on a non-competitive basis can benefit from the appearance of competition by asking other producers for estimates, even if they are not interested in purchasing from those particular producers, to determine if the bid they receive is reasonable.[3]

PRICE DATA

The Commission requested U.S. producers and importers to provide bid information concerning their 5 largest bids for mid-range and large-scale vector supercomputer, MPP, and SMP/SPP projects each year during January 1994-June 1997. U.S. purchasers were asked to provide bid information concerning all of their purchases of supercomputer systems during January 1994-June 1997. U.S. producers, importers, and purchasers were asked to provide cost breakouts (i.e., hardware costs, software costs, maintenance/service costs, etc.) as well as specification breakouts (i.e., technology offered, performance, memory size, etc.) for each bid reported. *** reported vector supercomputer bid information. *** reported MPP bid information, and *** reported SMP/SPP bid information. Reported bid information accounted for *** percent of U.S. producers' total U.S. sales of vector supercomputers, and all known U.S. sales of imported Japanese supercomputers during January 1994-June 1997. Vector supercomputer bid

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[2] Based on winning final-bid prices discussed in the next section, about *** percent of the reported value of vector supercomputer purchases during January 1994-June 1997 were single-sourced. This number is most likely significantly overstated since (1) most bids are closed and, therefore, responding producers and importers may not know who their competitors are; and (2) purchasers may not have maintained records of competing bids. Purchasers buy on a non-competitive basis for reasons such as compatibility with existing systems, cooperative agreements with supercomputer suppliers, purchasers opting to upgrade existing systems, and others.

[3] ***.

information is presented in tables V-1 to V-8[4] and figures V-2 to V-5.[5] MPP and SMP/SPP bid information is shown in appendix F, in tables F-1 to F-4 and figures F-1 and F-2.

Table V-1
Large-scale (greater than 7 Gflops) vector supercomputer sales not subject to "Buy American" restrictions: Final bid values for bids during Jan. 1994-June 1997, by cost component

* * * * * * *

Table V-2
Large-scale (greater than 7 Gflops) vector supercomputer sales not subject to "Buy American" restrictions: Final bid specifications for bids during Jan. 1994-June 1997, by specification

* * * * * * *

Table V-3
Large-scale (greater than 7 Gflops) vector supercomputer sales subject to "Buy American" restrictions (i.e., DOD-funded or classified sales): Final bid values for bids during Jan. 1994-June 1997, by cost component

* * * * * * *

Table V-4
Large-scale (greater than 7 Gflops) vector supercomputer sales subject to "Buy American" restrictions (i.e., DOD-funded and/or classified sales): Final bid specifications for bids during Jan. 1994-June 1997, by specification

* * * * * * *

Table V-5
Mid-range (between 1and 7 Gflops) vector supercomputer sales not subject to "Buy American" restrictions: Final bid values for bids during Jan. 1994-June 1997, by cost component

* * * * * * *

Table V-6
Mid-range (between 1 and 7 Gflops) vector supercomputer sales not subject to "Buy American" restrictions: Final bid specifications for bids during Jan. 1994-June 1997, by specification

* * * * * * *

[4] In the bid tables, the firm that won the bid is listed first. Bolded purchaser names indicate bid information that is based on purchaser questionnaire responses.

[5] ***.

Table V-7
Mid-range (between 1 and 7 Gflops) vector supercomputer sales subject to "Buy American" restrictions (i.e., DOD-funded or classified sales): Final bid values for bids during Jan. 1994-June 1997, by cost component

* * * * * * *

Table V-8
Mid-range (between 1 and 7 Gflops) vector supercomputer sales subject to "Buy American" restrictions (i.e., DOD-funded and/or classified sales): Final bid specifications for bids during Jan. 1994-June 1997, by specification

* * * * * * *

Figure V-2
Large-scale (greater than 7 Gflops) vector supercomputer sales not subject to "Buy American" restrictions: Final bid values during Jan. 1994-June 1997

* * * * * * *

Figure V-3
Large-scale (greater than 7 Gflops) vector supercomputer sales subject to "Buy American" restrictions (i.e., DOD-funded and/or classified sales): Final bid values during Jan. 1994-June 1997

* * * * * * *

Figure V-4
Mid-range (between 1 and 7 Gflops) vector supercomputer sales not subject to "Buy American" restrictions: Final bid values during Jan. 1994-June 1997

* * * * * * *

Figure V-5
Mid-range (between 1 and 7 Gflops) vector supercomputer sales subject to "Buy American" restrictions (i.e., DOD-funded and/or classified sales): Final bid values during Jan. 1994-June 1997

* * * * * * *

Price Trends[6]

Price/performance ratios ($million/Gflop) for large-scale (greater than 7 Gflops) CRI vector supercomputer systems not subject to "Buy American" restrictions ***.

[6] An industry rule-of-thumb known as "Moore's Law" estimates that, due to technical innovation, the price/performance ratios for vector supercomputers should decline by 10 percent every 18 months. ***.

***.[7]

Price/performance ratios for midrange (between 1 and 7 Gflops) CRI vector supercomputer systems not subject to "Buy American" restrictions ***.

Available price/performance ratios for mid-range CRI vector supercomputer systems subject to "Buy American" restrictions ***

Price Comparisons[8]

The Commission received competing CRI and imported Japanese bid information concerning ***.

* * * * * * *

LOST SALES AND LOST REVENUES[9]

CRI reported *** vector supercomputer lost sales allegations. The lost sales allegations involved ***. CRI estimated the value of the lost sales allegations to be between ***.[10] CRI also maintained that it lost revenues of over ***.[11]

***. A detailed description of the UCAR procurement is presented in appendix G.

* * * * * * *

[7] ***.

[8] Gflop ratings are based on theoretical peak performance, not actual sustained performance. A system's actual sustained performance, determined by running purchasers' selected benchmark codes on the competing systems, is a better measure of system performance than theoretical peak performance. However, in most cases, bid participants were unable to provide sustained performance information.

[9] The dates cited by CRI for its lost sales and lost revenues allegations refer to the date of CRI's initial price quotation.

[10] ***.

[11] ***.

PART VI: FINANCIAL CONDITION OF THE U.S. INDUSTRY

BACKGROUND

CRI,[1] the petitioner, provided financial data on vector supercomputers. Convex, the only other firm that produced vector supercomputers in the United States during January 1994-June 1997, could not provide separate data for vector supercomputers but did provide data for all supercomputers. Supercomputer producers receive revenue not only from sales, but from leases and service fees as well. For this reason and the fact that vector supercomputer prices can range from $250,000 to over $40 million, quantities sold have little correlation with financial performance on a per-unit basis and thus were not requested in the financial section of the questionnaire.

Data for CRI were verified by the Commission staff. As a result of the verification, changes were made by CRI to the income and loss data; capital expenditures; property, plant, and equipment; and production capability.

OPERATIONS ON VECTOR SUPERCOMPUTERS

The income-and-loss for CRI's vector supercomputer operations are presented in table VI-1.[2] CRI experienced ***. CRI explained that lower gross margins in 1995 compared to 1994 are the result of several factors: (1) sales gross margins were lower due to a shift in the product mix to smaller, lower-margin systems, (2) there was a decrease in sales and gross margins on the high-end products, and (3) service revenues, which have lower gross margins than products revenues, represented a greater percentage of total revenues in 1995.[3] High-end systems traditionally have generated most of CRI's sales revenue. The decrease in revenue derived from high-end system installations was partially offset by an increase in low-end system sales.[4] Leases ***.[5]

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[1] The data in this section, except for table VI-3, are only for vector supercomputers. Data for all supercomputers provided by Convex, CRI, IBM, Intel, SGI, and TMC are presented in app. I. CRI, IBM, Intel, and TMC provided financial data on MPPs. CRI and SGI provided data on SMPs and SPPs. CRI provided data ending Dec. 31 for the annual periods, even though in 1996 it changed its fiscal yearend to June 30 to correspond with that of its new parent, Silicon Graphics, Inc. SGI also provided data for the calendar year. IBM, Intel, and TMC have years ending in December. TMC did not provide data for the final phase of the investigation. TMC's data for 1994 and 1995 were taken from the preliminary phase of the investigation; the 1996 data were computed by Commission staff by annualizing the interim 1996 data from the preliminary phase. Convex's fiscal yearend was Dec. 31 until its purchase by Hewlett-Packard in Dec. 1995. Hewlett-Packard's yearend is Oct. 31; however, the data provided by Convex are on a calendar year basis (telephone conversation on Aug 27, 1997, with Cindy Shrader).

[2] For financial statement purposes, revenue from system sales is recognized at the time the system is accepted by the customer or independent distributor, or in the case of a conversion from lease to purchase, at the time of the customer's election to convert. Revenue from systems under operating lease contracts is recorded as earned over the lease term. Revenue from service fees is recognized monthly as earned..

[3] CRI's 1995 10K report.

[4] Ibid.

[5] Telephone conversation on Aug. 19, 1996, with Ms. Jill Nussbaum, Director of Financial Planning.

Table VI-1
Results of operations of CRI in the production of vector supercomputers, 1994-96, Jan.-June 1996, and Jan.-June 1997

* * * * * * *

CRI has a large customer base in government agencies and companies that ***. CRI's revenue from U.S. government agencies or commercial customers primarily serving the U.S. government totaled approximately $334 million in 1994 and $110 million in 1995, a decrease of approximately $224 million.[6]

Vector supercomputer export revenues are *** of CRI's total vector supercomputer revenues; consequently, these revenues are exposed to elements that can have adverse affects on total revenues and operating profits. Factors such as trade protection measures, export licensing regulations, changes in political conditions, and fluctuations in foreign currency exchange rates could have detrimental effects on the firm's results of operations.[7]

CRI realized its ***.

CRI's restructuring expenses[8] ***. The effects are presented in the following tabulation (in thousands of dollars):

* * * * * * *

Restructuring expenses for vector supercomputer operations (total and U.S. market only), MPPs, and SMPs were specifically identified, where possible, or otherwise allocated ***.[9]

OPERATIONS ON VECTOR SUPERCOMPUTERS (U.S. MARKET)

Income-and-loss data for CRI's vector supercomputer operations for the U.S. market only are presented in table VI-2. CRI has experienced the ***.

Table VI-2
Results of operations of CRI in the production of vector supercomputers (U.S. market only), 1994-96, Jan.-June 1996, and Jan.-June 1997

* * * * * * *

CRI's restructuring expenses ***, as shown in the following tabulation (in thousands of dollars):

* * * * * * *

[6] CRI's 1995 10K Report.

[7] Ibid.

[8] Restructuring expenses included workforce reductions, inventory write-downs, facilities write-downs and closings, and equipment write-downs and disposals (CRI's 1995 10K report). Restructuring expenses are proper costs of operations in accordance with Generally Accepted Accounting Principles (GAAP). Their effect on operations is provided to present the comparable results of operations without nonrecurring items.

[9] Telephone conversation, Mr. Steve Snyder, Director of Finance, July 21, 1997.

CAPITAL EXPENDITURES, RESEARCH AND DEVELOPMENT EXPENSES, AND INVESTMENT IN PRODUCTIVE FACILITIES

Capital expenditures, R&D expenses, and the original cost and book value of property, plant, and equipment used in the production of supercomputers are shown in table VI-3. Capital expenditures, R&D expenses, and the original cost and book value of fixed assets decreased in each year for all supercomputers and vector supercomputers. Capital expenditures for all and vector supercomputers increased in interim 1997 compared to interim 1996. R&D expenses increased in interim 1997 for all supercomputers but decreased for vector supercomputers when compared to interim 1996.

Table VI-3
Value of assets, capital expenditures, and research and development expenses of U.S. producers of supercomputers, 1994-96, Jan.-June 1996, and Jan.-June 1997

* * * * * * *

CAPITAL AND INVESTMENT

The producers' comments regarding any actual or potential negative effects of imports of vector supercomputers from Japan on their firms' growth, investment, ability to raise capital, and/or development and production efforts (including efforts to develop a derivative or more advanced version of the product) are presented in appendix J.

VI-3

PART VII: THREAT CONSIDERATIONS

The Commission analyzes a number of factors in making threat determinations (see 19 U.S.C. § 1677(7)(F)(I)). Information on the volume and pricing of imports of the subject merchandise is presented in parts IV and V, and information on the effects of imports of the subject merchandise on U.S. producers' existing development and production efforts is presented in part VI. Information on inventories of the subject merchandise; foreign producers' operations, including the potential for product-shifting; any other threat indicators, if applicable; and any dumping in third-country markets, follows.

THE INDUSTRY IN JAPAN

There are three known producers of vector supercomputers in Japan: Fujitsu Limited,[1] NEC Corporation,[2] and Hitachi Limited. The Japanese vector supercomputer producers are integrated producers. Fujitsu and NEC have made few sales of vector supercomputers to the United States and Hitachi has never sold such merchandise in the United States.[3] Data on Fujitsu's and NEC's production and shipments of vector supercomputers were provided by counsel in response to the Commission's foreign producer questionnaires and are presented in tables VII-1 and VII-2 at the end of this section. ***. ***.

* * * * * * *

The Japanese supercomputer market is significantly different from other supercomputer markets, as Japanese manufacturers and users rely more heavily than other countries on vector processing with a very high single processor performance.[4] Japanese manufacturers are currently integrating vector processing into scalable parallel computer architectures.[5] The move to RISC-based parallel computers is not as strong in Japan as in other parts of the world.[6] The Japanese dominate the domestic market[7] but have not exported a large number of their systems to other countries.[8]

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[1] Fujitsu is believed to be the largest Japanese vector supercomputer producer. Fujitsu estimates that its production of vector supercomputers in 1996 accounted for *** percent of total vector production in Japan.

[2] NEC estimates that its production of vector supercomputers in 1996 accounted for *** percent of total vector production in Japan.

[3] U.S. and Japanese supercomputer vendors dominate their respective home markets, while European supercomputer manufacturers play only a minor role in the world market or in their own region. The Top500 for 1996 was led by three Japanese systems installed in Japan.

[4] As a result of this, Japan's share of the world market is much lower when measured in the number of systems installed than when measured by Rmax in the Linpack benchmark.

[5] Scalable vector parallel computers have been introduced by both Fujitsu and NEC to combine the high single processor performance of vector processors with the high scalability of parallel processing. See Fujitsu's posthearing brief, p. 6 of Responses to the Commission's Questions.

[6] The Japanese continue to rely on vector instructions and large SRAM memories for computing power, while at the same time MPP systems are being investigated in manufacturers' and users' research labs.

[7] CRI has operated in Japan since 1980, mainly in commercial organizations such as car manufacturers and universities.

[8] The Japanese have been more successful in the Canadian and European vector supercomputer markets than in the United States.

The Japanese decided in the late 1970s to produce their own vector-based supercomputers, ***. Production and sales of vector supercomputers began in 1983. Prior to that, the Japanese government had allocated no funds for supercomputer procurement, but soon after Japan's integrated electronics firms began to make supercomputers, the government began funding such procurements. The inability of American manufacturers of vector supercomputers to penetrate the growing Japanese government procurement market soon became a bilateral trade issue between the United States and Japan.[9] There was an attempt to remedy this problem through the adoption of a bilateral agreement in 1987. The 1987 agreement produced unsatisfactory results and led to the negotiation of the 1990 agreement on supercomputers. Results from that agreement have been mixed.[10] Procurements of U.S. supercomputers increased in 1993 and 1994 but declined in 1995. The U.S. share of the Japanese public sector market remains far lower than the U.S. share of the Japanese private sector market.[11]

Fujitsu introduced its first vector supercomputer in the 1970s and various product lines have been introduced since that time. The VPP300, introduced in 1995, is the most powerful and compact of its vector supercomputers to date.[12]

NEC is one of the world's oldest providers of semiconductor, computer, and communications technology. The SX-4 series, announced in November 1994, combines a scalable parallel vector architecture with CMOS technology.[13] ***.[14] ***. ***.[15] ***. During fiscal 1995, NEC introduced in Japan the parallel ACOS series, a new generation of mainframe computers that employ parallel processing technology.

Hitachi has not introduced a new vector supercomputer in over 3½ years and has announced no plans to bring out the current model's successor.[16] ***. ***.

In an industry characterized by a limited number of high-value, custom-configured sales (or leases), capacity appears to be determined primarily by sales levels rather than production constraints or ceilings. Fujitsu and NEC were quoted in the Japanese press in July 1996 as hoping to expand sales volumes by 100 percent and 63 percent (by number of orders), respectively, in fiscal year 1996 compared

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[9] Telegram from the American Embassy, Tokyo, Japan, Aug. 23, 1996.

[10] Ibid.

[11] Ibid. Fujitsu noted at the hearing that the Japanese government has purchased at least 20 U.S. supercomputers since 1993 while Japan is restricted to the private sector in its sales to the United States; hearing transcript, pp. 150-151.

[12] ***; Fujitsu's questionnaire response.

[13] The SX-3 series was based on ECL technology.

[14] NEC's supercomputers, mainframes, and other products accounted for ***.

[15] ***.

[16] Hitachi offers MPP systems based on commodity RISC processors, as well as its older shared memory, proprietary vector processor system S3800.

to fiscal year 1995.[17] Other Japanese press reports have cited Fujitsu and NEC as hoping to increase exports to the United States and Europe of less expensive CMOS processor-based supercomputers.[18]

Japanese supercomputer exports face no significant tariff barriers or antidumping findings in export markets. Fujitsu and NEC have enjoyed some export success in Europe and Canada, two regions with negligible domestic competition. Information obtained from the U.S. Embassy indicates that Japanese manufacturers tried to establish themselves in Europe and Canada before entering the U.S. market due to the well-established position of U.S. supercomputer makers in their domestic market and also possibly due to recurrent bilateral trade tensions over U.S. access to the Japanese market. Exports to other regions of the world are limited primarily by cost.[19]

Fujitsu and NEC reported ***.[20] ***. Based on the historical pattern of supercomputer and mainframe production, as well as the physical, logistical, and human bottlenecks in the production process, product shifting is unlikely.[21]

U.S. IMPORTERS' INVENTORIES

U.S. importers of Japanese vector supercomputers do not generally hold inventories because the subject products are produced to specifications for particular contracted projects. The three importers of vector supercomputers from Japan reported maintaining *** of the product in 1994. HNSX reported *** in inventory in 1995, and HNSX and Fujitsu reported a total of *** in inventory in 1996 (table VII-3).

U.S. IMPORTERS' CURRENT ORDERS

No orders for vector supercomputers from Japan were reported by U.S. importers for delivery after June 30, 1997. The NEC contract with FCC/NCAR/UCAR[22] for the purchase of 4 SX-4/32s, the first of which was to have been delivered in October 1996,[23] is discussed in detail in appendix H of this report.[24]

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[17] Mr. Miura, Fujitsu, testified at the hearing that Japan has always had sufficient capacity to increase its exports to the United States but that such exports are small, especially when compared to its sales in Europe and other markets. Long procurement cycles, lack of adequate computer support capability, and the absence of working relationships with potential customers make it impossible as a practical matter for Fujitsu to significantly increase its supercomputer sales; hearing transcript, pp. 152-153.

[18] Telegram from the American Embassy, op. cit.

[19] Ibid.

[20] Mr. Miura testified at the hearing that Fujitsu produces its supercomputers to order and does not maintain inventories or surpluses; hearing transcript, p. 152.

[21] NEC's postconference brief, p. 49.

[22] As indicated earlier in this report, UCAR is a non-profit consortium of 61 North American institutions engaged in climate research. UCAR manages NCAR in Boulder, CO.

[23] The contract with the FCC was ***. Dr. Neal Lane, Director, NSF, announced on Aug. 29, 1997, that because of Commerce's final determination of sales at LTFV, NSF will not approve the NCAR procurement of NEC's supercomputers; World Wide Web, http://www.nsf.gov/od/lpa/news/media/lcar.htm.

[24] See also UCAR's questionnaire response and UCAR's supplemental questionnaire response; testimony of Dr. Buzbee, NCAR, hearing transcript, pp. 185-190; and NEC/HNSX's prehearing brief, pp. 41-45.

Table VII-1
Summary data for Japanese producers of vector supercomputers (systems), 1994-96, Jan.-June 1996, Jan.-June 1997, and projected 1997-98

* * * * * * *

Table VII-2
Summary data for Japanese producers of vector supercomputers (gigaflops), 1994-96, Jan.-June 1996, Jan.-June 1997, and projected 1997-98

* * * * * * *

Table VII-3
Vector supercomputers: U.S. importers' end-of-period inventories of imports from Japan, 1994-96, Jan.-June 1996, and Jan.-June 1997

* * * * * * *

APPENDIX A

FEDERAL REGISTER NOTICES

A-1

INTERNATIONAL TRADE COMMISSION

[Investigation No. 731-TA-750 (Final)]

Vector Supercomputers From Japan

AGENCY: United States International Trade Commission.

ACTION: Scheduling of the final phase of an antidumping investigation.

SUMMARY: The Commission hereby gives notice of the scheduling of the final phase of antidumping investigation No. 731-TA-750 (Final) under section 735(b) of the Tariff Act of 1930 (19 U.S.C. §1673d(b)) (the Act) to determine whether an industry in the United States is materially injured or threatened with material injury, or the establishment of an industry in the United States is materially retarded, by reason of less-than-fair-value imports from Japan of vector supercomputers, provided for in heading 8471 of the Harmonized Tariff Schedule of the United States.[1]

For further information concerning the conduct of this phase of the investigation, hearing procedures, and rules of general application, consult the Commission's Rules of Practice and Procedure, part 201, subparts A through E (19 CFR part 201), and part 207, subparts A and C (19 CFR part 207), as amended by 61 FR 37818, July 22, 1996.

EFFECTIVE DATE: April 1, 1997.

[1] For purposes of this investigation, Commerce has defined the subject merchandise as "all vector supercomputers, whether new or used, and whether in assembled or unassembled form, as well as vector supercomputer spare parts, repair parts, upgrades, and system software shipped to fulfill the requirements of a contract for the sale and, if included, maintenance of a vector supercomputer. A vector supercomputer is any computer with a vector hardware unit as an integral part of its central processing unit boards."

FOR FURTHER INFORMATION CONTACT: Valerie Newkirk (202–205–3190). Office of Investigations. US International Trade Commission. 500 E Street SW. Washington. DC 20436. Hearing-impaired persons can obtain information on this matter by contacting the Commission's TDD terminal on 202–205–1810. Persons with mobility impairments who will need special assistance in gaining access to the Commission should contact the Office of the Secretary at 202–205–2000. General information concerning the Commission may also be obtained by accessing its internet server (http://www.usitc.gov or ftp://ftp.usitc.gov)

SUPPLEMENTARY INFORMATION:

Background

The final phase of this investigation is being scheduled as a result of an affirmative preliminary determination by the Department of Commerce that imports of vector supercomputers from Japan are being sold in the United States at less than fair value within the meaning of section 733 of the Act (19 USC § 1673b). The investigation was requested in a petition filed on July 29. 1996. by Cray Research. Inc.. Eagan. MN.

Participation in the Investigation and Public Service List

Persons. including industrial users of the subject merchandise and. if the merchandise is sold at the retail level. representative consumer organizations wishing to participate in the final phase of this investigation as parties must file an entry of appearance with the Secretary to the Commission. as provided in section 201.11 of the Commission's rules. no later than 21 days prior to the hearing date specified in this notice. A party that filed a notice of appearance during the preliminary phase of the investigation need not file an additional notice of appearance during this final phase. The Secretary will maintain a public service list containing the names and addresses of all persons. or their representatives. who are parties to the investigation.

Limited Disclosure of Business Proprietary Information (BPI) Under an Administrative Protective Order (APO) and BPI Service List

Pursuant to section 207.7(a) of the Commission's rules. the Secretary will make BPI gathered in the final phase of this investigation available to authorized applicants under the APO. issued in the investigation. provided that the application is made no later than 21 days prior to the hearing date specified in this notice. Authorized applicants must represent interested parties. as defined by 19 U.S.C. § 1677(9). who are parties to the investigation. A party granted access to BPI in the preliminary phase of the investigation need not reapply for such access. A separate service list will be maintained by the Secretary for those parties authorized to receive BPI under the APO.

Staff Report

The prehearing staff report in the final phase of this investigation will be placed in the nonpublic record on August 12. 1997. and a public version will be issued thereafter. pursuant to section 207.22 of the Commission's rules.

Hearing

The Commission will hold a hearing in connection with the final phase of this investigation beginning at 9:30 am on August 27. 1997. at the US International Trade Commission Building. Requests to appear at the hearing should be filed in writing with the Secretary to the Commission on or before August August 19. 1997. A nonparty who has testimony that may aid the Commission's deliberations may request permission to present a short statement at the hearing. All parties and nonparties desiring to appear at the hearing and make oral presentations should attend a prehearing conference to be held at 9.30 a.m. on August 22. 1997. at the U.S. International Trade Commission Building. Oral testimony and written materials to be submitted at the public hearing are governed by sections 201.6(b)(2). 201.13(f). and 207.24 of the Commission's rules. Parties must submit any request to present a portion of their hearing testimony *in camera* no later than 7 days prior to the date of the hearing.

Written Submissions

Each party who is an interested party shall submit a prehearing brief to the Commission. Prehearing briefs must conform with the provisions of section 207.23 of the Commission's rules; the deadline for filing is August 21. 1997. Parties may also file written testimony in connection with their presentation at the hearing. as provided in section 207.24 of the Commission's rules. and posthearing briefs. which must conform with the provisions of section 207.25 of the Commission's rules. The deadline for filing posthearing briefs is September 4. 1997; witness testimony must be filed no later than three days before the hearing. In addition. any person who has not entered an appearance as a party to the investigation may submit a written statement of information pertinent to the subject of the investigation on or before September 4. 1997. On September 19. 1997. the Commission will make available to parties all information on which they have not had an opportunity to comment. Parties may submit final comments on this information on or before September 23. 1997. but such final comments must not contain new factual information and must otherwise comply with section 207.30 of the Commission's rules. All written submissions must conform with the provisions of section 201.8 of the Commission's rules; any submissions that contain BPI must also conform with the requirements of sections 201.6. 207.3. and 207.7 of the Commission's rules.

In accordance with sections 201.16(c) and 207.3 of the Commission's rules. each document filed by a party to the investigation must be served on all other parties to the investigation (as identified by either the public or BPI service list). and a certificate of service must be timely filed. The Secretary will not accept a document for filing without a certificate of service.

Authority: This investigation is being conducted under authority of title VII of the Tariff Act of 1930; this notice is published pursuant to section 207.21 of the Commission's rules.

By order of the Commission.

Issued: April 28. 1997

Donna R. Koehnke.

Secretary

[FR Doc. 97–11862 Filed 5–6–97; 8:45 am]

BILLING CODE 7020–02–P

DEPARTMENT OF COMMERCE

International Trade Administration

[A-588-841]

Notice of Final Determination of Sales at Less Than Fair Value: Vector Supercomputers From Japan

AGENCY: Import Administration. International Trade Administration. Department of Commerce.

EFFECTIVE DATE: August 28. 1997.

FOR FURTHER INFORMATION CONTACT: Edward Easton or Sunkyu Kim. Office of AD/CVD Enforcement II. Import Administration. International Trade Administration. U.S. Department of Commerce. 14th Street and Constitution Avenue. NW.. Washington. DC 20230: telephone: (202) 482-1777 or (202) 482-2613.

The Applicable Statute

Unless otherwise indicated. all citations to the Tariff Act of 1930. as

amended ("the Act"), are references to the provisions effective January 1, 1995 the effective date of the amendments made to the Act by the Uruguay Round Agreements Act (URAA). In addition, unless otherwise indicated, all citations to the Department's regulations are to those codified at 19 CFR 353 (April 1, 1996).

Final Determination

We determine that vector supercomputers from Japan are being sold in the United States at less than fair value ("LTFV"), as provided in section 735(b) of the Act. The estimated margins of sales at LTFV are shown in the "Suspension of Liquidation" section of this notice.

Case History

Since the preliminary determination of sales at less than fair value in this investigation on March 28, 1997, (62 FR 16544, April 7, 1997) ("*Preliminary Determination*"), the following events have occurred.

As discussed in the *Preliminary Determination*, on January 28, 1997, we initiated a sales below the cost of production ("COP") investigation with respect to Fujitsu Ltd.'s ("Fujitsu") home market sales. Section D of the Department's questionnaire requesting COP and constructed value ("CV") data was issued to Fujitsu on February 12, 1997. Fujitsu submitted its response to Section D of the questionnaire on April 14, 1997. Based on our analysis of Fujitsu's response to Section D, we issued a supplemental questionnaire on April 28, 1997. The response to this supplemental questionnaire was due on May 12, 1997. On May 7, 1997, at Fujitsu's request, we met with Fujitsu's counsel and corporate representative concerning the Department's Section D supplemental questionnaire. At the May 7 meeting, Fujitsu raised concerns about the scope of the questions and the availability of requested information. On May 8, 1997, Fujitsu requested an extension of time until May 19, 1997, to submit its response to the supplemental questionnaire. In its letter, Fujitsu stated that it would file as much of its response as it could prepare by May 12, 1997, and file the remainder of its response by May 19, 1997. We granted this request on May 9, 1997.

On May 12, 1997, Fujitsu submitted a portion of its response to the supplemental cost questionnaire. Fujitsu, however, failed to submit the remainder of its response on May 19, 1997. On May 20, 1997, Fujitsu submitted a letter stating that it would no longer participate in the Department's investigation and that it would concentrate its opposition to the petition in the material injury investigation conducted by the International Trade Commission ("ITC"). In this letter, Fujitsu stated that it based its decision on the conclusion that it could not provide a complete response to the Department's supplemental cost questionnaire by the May 19, 1997 deadline and that the company's resources would be better served by participating in the ITC's investigation. As a result of Fujitsu's decision to not complete its response to the Department's supplemental questionnaire, we are applying facts otherwise available in our final determination. For a further discussion, see "Facts Available" section below.

As requested in the Preliminary Determination, comments on the suspension of liquidation instructions were submitted by Fujitsu and the petitioner, Cray Research, Inc. ("Cray"), on May 12, 1997. The petitioner submitted its responses to Fujitsu's comments on May 19, 1997. For a further discussion, see Comments 2, 3, and 4, below.

Both Fujitsu and the petitioner submitted case briefs on July 7, 1997, and rebuttal briefs on July 11, 1997. At the request of Fujitsu, a public hearing was held on July 16, 1997.

Scope of Investigation

The products covered by this investigation are all vector supercomputers, whether new or used, and whether in assembled or unassembled form, as well as vector supercomputer spare parts, repair parts, upgrades, and system software, shipped to fulfill the requirements of a contract entered into on or after April 7, 1997, for the sale and, if included, maintenance of a vector supercomputer. A vector supercomputer is any computer with a vector hardware unit as an integral part of its central processing unit boards.

In general, the vector supercomputers imported from Japan, whether assembled or unassembled, covered in this investigation are classified under heading 8471 of the Harmonized Tariff Schedules of the United States ("HTS"). Merchandise properly classifiable under HTS Number 8471.10 and 8471.30, however, is excluded from the scope of this investigation. These references to the HTS are provided for convenience and customs purposes. Our written description of the scope of this investigation is dispositive.

This scope language has been modified from that issued in our preliminary determination. The reason for the modification is discussed in Comment 3, below.

Period of Investigation

The period of investigation ("POI") is July 1, 1995 through June 30, 1996.

Facts Available

Section 776(a)(2) of the Act provides that if an interested party (1) withholds information that has been requested by the Department, (2) fails to provide such information in a timely manner or in the form or manner requested, (3) significantly impedes an antidumping investigation, or (4) provides such information but the information cannot be verified, the Department is required to use facts otherwise available (subject to subsections 782(c)(1) and (e)) to make its determination. Section 776(b) of the Act provides that adverse inferences may be used against an interested party if that party failed to cooperate by not acting to the best of its ability to comply with requests for information. *See also* "Statement of Administrative Action" accompanying the URAA, H.R. Rep. No. 316, 103rd Cong., 2d Sess. 870 (SAA). Fujitsu's decision not to respond fully to the Department's supplemental cost questionnaire or to other requests for information by the Department demonstrates that it failed to act to the best of its ability in this investigation. Therefore, the Department has determined that an adverse inference is appropriate. In addition, for the reasons described in the *Preliminary Determination*, we find that the application of adverse facts available is appropriate for NEC as well. Consistent with Departmental practice in cases where respondents refuse to participate, as facts otherwise available, we have considered assigning a margin stated in the petition.

A. Fujitsu

In its petition, Cray alleged that Fujitsu had delivered a four processor vector supercomputer system to a U.S. customer, Western Geophysical Co., for petroleum industry modeling applications. Cray alleged also that the U.S. customer had not paid for or contracted to purchase the system and, consequently, was unable to calculate an estimated dumping margin for this Fujitsu sale. (The only calculated estimated dumping margin in the petition concerned vector supercomputer systems offered to a different U.S. customer by NEC Corporation.) After the initiation of this investigation, the petitioner contacted the Department to report that Cray's allegation that Fujitsu had not been paid by Western Geophysical Co. for this sale

was mistaken. See, Memorandum to the File from the Case Analysts, dated August 11, 1997

Section 776(c) provides that if the Department relies upon secondary information, such as the petition, when resorting to facts otherwise available, it must, to the extent practicable, corroborate that information using independent sources that are reasonably at its disposal. To corroborate the information the petitioner asserted with respect to Fujitsu's U.S. sale, the Department conducted a computerized search of published documents. See, Memorandum to the File, from the Case Analysts, dated August 12, 1997. This search disclosed that the October 23, 1995 issue of the Japan Economic Journal discussed Fujitsu's sale of a four-processor supercomputer to Western Geophysical Co. for a price of $2 million. The search also disclosed that the November 1, 1995 issue of Japan Economic Institute Report ("JEI Report") discussed the Fujitsu sale of a four-processor supercomputer to Western Geophysical Co. The JEI Report stated that the Fujitsu supercomputer had a list price of $2 million. Both the Japan Economic Journal and JEI Report reported that the sale was made by Fujitsu; neither publication referred to the participation of a systems integrator. On the basis of this information, the Department adjusted the petition margin calculated for NEC to determine a margin for Fujitsu based on facts otherwise available.

For the export price, we used Fujitsu's $2 million price for the four-processor supercomputer sold to Western Geophysical Co. as the starting price. We adjusted this starting price to account for the absence of a systems integrator in the Western Geophysical Co. sale. We compared this export price to the CV of a vector supercomputer system calculated in the petition. We adjusted the petition CV to account for the number of processors in Fujitsu's sale to Western Geophysical Co. The resulting dumping margin of 173.08 percent was assigned to Fujitsu as facts otherwise available. See, Memorandum to the File from the Case Analyst, dated August 13, 1997.

B. NEC Corporation

As discussed in the *Preliminary Determination*, NEC Corporation ("NEC") failed to answer the Department's questionnaire. Accordingly, the Department assigned to NEC the margin stated in the petition, 454 percent, as facts otherwise available. At the preliminary determination, the Department corroborated the information contained in the petition within the meaning of section 776(c) of the Act and found the information to have probative value; *i.e.*, it is both relevant and reliable. Since the preliminary determination, no party (including NEC) has presented to the Department any information to challenge the appropriateness of the information contained in the petition as the basis for a facts available margin for NEC. Accordingly, for the final determination, we continue to assign NEC the margin stated in the petition, 454 percent.

C. The All Others Rate

This investigation has the unusual circumstance of both foreign manufacturer/exporters being assigned dumping margins on the basis of facts otherwise available. NEC and Fujitsu are the only Japanese manufacturers of the subject merchandise which have made competing bids for sales to the United States. Section 735(c)(5) of the Act provides that where the dumping margins established for all exporters and exporters and producers individually investigated are determined entirely under section 776, the Department "* * * may use any reasonable method to establish the estimated all-others rate for exporters and producers not individually investigated, including averaging the estimated weighted average dumping margins determined for the exporters and producers individually investigated." This provision contemplates that we weight-average the facts-available margins to establish the all others rate. Where the data is not available to weight-average the facts available rates, the SAA, at 873, provides that we may use other reasonable methods.

Inasmuch as we do not have the data necessary to weight average the NEC and Fujitsu facts-available margins, we have taken the simple average of these margins to apply as the all others rate. This calculation establishes an all others rate of 313.54 percent.

Interested Party Comments

Comment 1 Use of Facts Available for Fujitsu

The petitioner argues that Fujitsu's decision to end its participation in the Department's investigation gives the Department no option but to assign to Fujitsu a dumping margin based on facts available. Further, the petitioner asserts that Fujitsu has not cooperated with the Department in this investigation and that adverse inferences are appropriate in assigning a facts available margin to Fujitsu.

In choosing the appropriate adverse facts available margin, the petitioner notes that although a facts available margin based solely on the information contained in the petition would be consistent with both the statute and Department practice, an alternative approach based on certain data submitted by Fujitsu and adjusted by the petitioner would be more accurate and, therefore, preferred. Using certain data from Fujitsu's questionnaire responses, the petitioner calculated a facts available dumping margin of 388.74 percent. This margin is based on a comparison of an export price and constructed value for Fujitsu's single U.S. sale made during the POI. In calculating the export price, the petitioner made several adjustments to the export price information submitted by Fujitsu. These adjustments include (1) an estimate of U.S. indirect selling expenses based on SG&A expenses reported by Fujitsu's U.S. subsidiary, Fujitsu America, Inc.'s ("FAI") Supercomputer Group; (2) use of a gross U.S. price which includes service revenues for a shorter period of time than that used by Fujitsu; and (3) a recalculation of freight charges, imputed credit, and inventory carrying costs. In calculating the CV for Fujitsu's U.S. sale, the petitioner calculated a value based on adjusted amounts for the cost of manufacture, research and development, general and selling expenses and profit.

Fujitsu acknowledges that the incompleteness of its unverified information on the record in this investigation requires that the Department establish a dumping margin on the basis of facts otherwise available. Fujitsu asserts that the Department has a great deal of discretion within which to assign a margin and requests that the Department either assign the dumping margin calculated for the preliminary determination or adjust the calculation in the petition that was used to determine an alleged dumping margin for NEC.

DOC Position

The Department has assigned a margin based on facts otherwise available for Fujitsu because Fujitsu refused to cooperate in our investigation and prevented our making an accurate margin calculation. We rejected Fujitsu's request to assign the dumping margin calculated for the preliminary determination as facts available. This preliminary margin was calculated before the Department had received Fujitsu's responses to the cost-of-production and constructed value section of our antidumping

questionnaire. For this final determination. the Department relied upon information in the petition. with appropriate adjustments. which Fujitsu suggested as an alternative to the preliminary determination margin. However. we did not accept adjustments to the petition information that Fujitsu made in its recalculation of the petition margin where we were unable to corroborate the adjustment or verify the data relied upon.

The Department also rejected the petitioner's estimated dumping margin for Fujitsu. The petitioner's estimate relied on unverified submissions as well as several of its own assumptions and adverse inferences. Although the petitioner asserts that its calculation is more accurate than relying on information in the petition. we believe that its approach is speculative.

Comment 2 Entries to be Used in the United States Exclusively by Fujitsu

Fujitsu asserts that the Department should not order the suspension of liquidation on entries of covered merchandise for the exclusive use of Fujitsu in the United States. Alternatively. Fujitsu suggests that liquidation be suspended for such entries and that the cash deposit rate for these entries be set at zero. Fujitsu argues that collecting deposits on these entries is unreasonable inasmuch as they will never be sold. The company cites to several Department determinations which excluded certain products from the scope of an investigation on the basis of end-use certificates.

The petitioner asserts that suspension of liquidation must be ordered for these entries. Without suspension of liquidation. the merchandise will enter the United States without the Department or the U.S. Customs Service being in a position to verify that they were used exclusively by Fujitsu Similarly. the petitioner asserts that cash deposits in the amount of the assigned antidumping duty margin be collected to ensure that the merchandise is not sold after it's used by Fujitsu The petitioner would have the cash deposits returned to Fujitsu only after the merchandise were reexported or destroyed under the supervision of the Customs Service.

DOC Position

The Department agrees with the petitioner that liquidation of these entries must be suspended because the merchandise is covered by the scope of the investigation and will enter the customs territory of the United States. In the event that merchandise were to be sold after entry. the suspension of liquidation would safeguard the government's ability to collect antidumping duties. With respect to the collection of cash deposits. the Department is not authorized to order the suspension of liquidation but then to set the cash deposit rate at zero in circumstances where the entered merchandise is clearly covered by the scope of the antidumping duty investigation.

We have examined the citations offered by Fujitsu. They are concerned with investigations in which the scope was defined by the use of the product and other uses were not covered by the scope of investigation. In this investigation. Fujitsu is claiming that vector supercomputer systems that it imports into the United States for its own use ought to be exempt from cash deposits from the order because a related company will be using the covered merchandise exclusively. This is not the situation where certain uses of a vector supercomputer were excluded from the scope of the investigation.

Comment 3 Contracts Entered Into Prior to Suspension of Liquidation

Fujitsu requests that the Department clarify that the suspension of liquidation instructions do not apply to "follow on" importations pursuant to contracts for the sale of vector supercomputers entered into prior to the date of suspension of liquidation in this investigation. April 7. 1997.

Although the petitioner did not address Fujitsu's request in its pre-hearing submissions. it objected to this request at the hearing.

DOC Position

The Department agrees with Fujitsu. We had intended that the suspension of liquidation instructions in our *Preliminary Determination* would apply to entries pursuant to any contract for the sale of a vector supercomputer system on or after the date of its their publication in the Federal Register.

Comment 4 Reporting Requirements

Both the petitioner and Fujitsu commented on the Department's requirements set forth in the *Preliminary Determination* for reporting information to the U.S. Customs Service and the Department on entry of the subject merchandise.

This information included copies of the contracts pursuant to which the entries were being made. a description of the merchandise being entered. the actual or estimated price of the complete vector supercomputer system. and a schedule of all future shipments to be made pursuant to the contract. Both parties were concerned that much of the information requested by the Department in the *Preliminary Determination* was not necessary.

DOC Position

On the basis of these comments and consultations with the U.S. Customs Service. the Department is requiring only that the U.S. importer submit with its entry summary a detailed description of the merchandise included in the entry with documentation that identifies the contract pursuant to which the merchandise is being imported. After examining this documentation for consistency with the entry summary. the Customs Service will forward the documentation to the Department. Detailed descriptions of entries and the identification of the relevant sales contracts are necessary for the Department to be apprised of entries subject to the order independent of administrative reviews and scope inquiries. We expect. also. that the petitioner will inform the Department when it becomes aware of U.S. vector supercomputer contracts being awarded to Japanese manufacturers.

Continuation of Suspension of Liquidation

In accordance with section 735(c)(4)(A) of the Act. we are directing the Customs Service to continue to suspend liquidation of all entries of vector supercomputers from Japan. as defined in the "Scope of Investigation" section of this notice. that are entered. or withdrawn from warehouse. for consumption on or after April 7. 1997. the date of publication of our preliminary determination in the Federal Register. For these entries. the Customs Service will require a cash deposit or posting of a bond equal to the estimated amount by which the normal value exceeds the export price as shown below.

MFR/producer exporter	Margin percentage
Fujitsu Ltd.	173.08
NEC Corp.	454.00
All Others	313.54

Entry summaries covering merchandise within the scope of this investigation must be accompanied by documentation provided by the U.S. importer which identifies the vector supercomputer contract pursuant to which the merchandise is imported and describes in detail the merchandise included in the entry. After examining this documentation for consistency with

the entry summary. the Customs Service will forward the documentation to the Department.

ITC Notification

In accordance with section 735(d) of the Act. we have notified the ITC of our determination. As our final determination is affirmative. the ITC will determine whether these imports are causing material injury. or threat of material injury. to the industry within 45 days of its receipt of this notification.

If the ITC determines that material injury. or threat of material injury. does not exist. the proceeding will be terminated and all securities posted will be refunded or canceled. If the ITC determines that such injury does exist. the Department will issue an antidumping duty order directing Customs officials to assess antidumping duties on all imports of the subject merchandise entered. or withdrawn from warehouse. for consumption on or after the effective date of the suspension of liquidation.

This determination is published pursuant to section 735(d) of the Act.

Dated. August 20. 1997

Robert S. LaRussa.

Assistant Secretary for Import Administration

[FR Doc. 97-22968 Filed 8-27-97; 8:45 am]

BILLING CODE 3510-DS-P

APPENDIX B

PARTICIPANTS AT THE HEARING

B-1

CALENDAR OF PUBLIC HEARING

Those listed below appeared as witnesses at the United States International Trade Commission's hearing:

Subject	:	VECTOR SUPERCOMPUTERS FROM JAPAN
Inv. No.	:	731-TA-750 (Final)
Date and Time	:	August 27, 1997 - 9:30 a.m.

Sessions were held in connection with the investigation in the Main Hearing Room 101, 500 E Street, S.W., Washington, D.C.

OPENING REMARKS

Petitioner (**John Greenwald**, Wilmer, Cutler & Pickering)
Respondents (**Warren E. Connelly**, Akin, Gump, Strauss & Feld, L.L.P.)

In Support of the Imposition of Antidumping Duties:

Wilmer, Cutler & Pickering
Washington, D.C.
on behalf of

Cray Research, Incorporated

Irene Qualters, President, Cray Research
Earl Joseph, Director, Competitive Intelligence, Cray Research
John Sullivan, Vice President and General Counsel, Cray Research
Charles Grassl, System Engineer Specialist, Cray Research
Timothy Ward, Branch Manager, Cray Research
Paul Ciernia, Director, Sales Administration, Cray Research
Jim Abeles, System Engineer, Cray Research
Richard Boyce, Economist, Econometrica International, Incorporated

John Greenwald
Charles Levy)--OF COUNSEL
Ronald Meltzer

B-3

In Opposition to the Imposition of Antidumping Duties:

Akin, Gump, Strauss, Hauer & Feld, L.L.P.
Washington, D.C.
on behalf of

Fujitsu Limited
Fujitsu America, Incorporated

Dr. Ken Miura, Chief Scientist, HPC Group, Fujitsu Limited

Warren E. Connelly)
)--**OF COUNSEL**
James E. Mendenhall)

Paul, Weiss, Rifkind, Wharton & Garrison
Washington, D.C.
on behalf of

NEC Corporation
HNSX Supercomputers, Incorporated

Samuel W. Adams, Vice President, Sales and Marketing, HNSX Supercomputers, Incorporated
Philip Tannenbaum, Director of Marketing Group, HNSX Supercomputers, Incorporated
John Levesque, President, Applied Parallel Research
Dr. Seth Kaplan, Economist, Trade Resources, Incorporated

Terence J. Fortune)
Robert E. Montgomery)--**OF COUNSEL**
David J. Weiler)

B-4

In Opposition to the Imposition of Antidumping Duties--Continued:

Holme Roberts & Owen L.L.P.
Denver, Colorado
on behalf of

University Corporation for Atmospheric Research (UCAR), Boulder, Colorado

Dr. Bill Buzbee, Director, Scientific Computing Division, National Center for Atmospheric Research
Bernard T. O'Lear, Associate Director, Scientific Computing Division, National Center for Atmospheric Research
Jeff Reaves, Associate Vice President, Finance and Administration, National Center for Atmospheric Research
Dr. James Hack, Scientific III, Climate and Global Dynamics Division, Climate Modeling Section, National Center for Atmospheric Research
Dr. Steve Hammond, Manager, Computational Science Section , Scientific Computing Division, National Center for Atmospheric Research

Frank J. Schuchat-- OF COUNSEL

B-5

APPENDIX C

SUMMARY TABLES

C-1

Table C-1
Vector supercomputers: Summary data concerning the U.S. market using systems as the measure of quantity, 1994-96, Jan.-June 1996, and Jan.-June 1997

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Table C-2
Vector supercomputers: Summary data concerning the U.S. market using gigaflops as the measure of quantity, 1994-96, Jan.-June 1996, and Jan.-June 1997

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Table C-3
Massively parallel processors (MPPs): Summary data concerning the U.S. market, 1994-96, Jan.-June 1996, and Jan.-June 1997

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Table C-4
Symmetric multiprocessors (SMPs) and scalable parallel processors (SPPs): Summary data concerning the U.S. market, 1994-96, Jan.-June 1996, and Jan.-June 1997

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Table C-5
Total supercomputers: Summary data concerning the U.S. market, 1994-96, Jan.-June 1996, and Jan.-June 1997

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C-3

APPENDIX D

SUPERCOMPUTER SPECIFICATION RANGES

D-1

Table D-1
Specification ranges of CRI computer models

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Table D-2
Specification ranges of Fujitsu computer models

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Table D-3
Specification ranges of SGI computer models

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Table D-4
Specification ranges of IBM computer models

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Table D-5
Specification ranges of NEC computer models

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Table D-6
Specification ranges of Intel computer models

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APPENDIX E

SUPERCOMPUTER END USE APPLICATIONS

E-1

Table E-1
Applications/end uses for which specific supercomputer models are employed, as reported by U.S. producers and importers

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Table E-2
Applications/end uses for which specific supercomputer models are employed, as reported by U.S. purchasers

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E-3

APPENDIX F

MPP AND SMP/SPP SALES

F-1

Table F-1
MPP sales: Final bid values for bids during Jan. 1994-June 1997, by cost component

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Table F-2
MPP sales: Final bid specifications for bids during Jan. 1994-June 1997, by specification

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Table F-3
SMP/SPP sales: Final bid values for bids during Jan. 1994-June 1997, by cost component

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Table F-4
SMP/SPP sales: Final bid specifications for bids during Jan. 1994-June 1997, by specification

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Figure F-1
MPP sales: Final bid values for bids during Jan. 1994-June 1997

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Figure F-2
SMP/SPP sales: Final bid values for bids during Jan. 1994-June 1997

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F-3

APPENDIX G

INFORMATION CONCERNING ***'S PROCUREMENT

G-1

INFORMATION CONCERNING ***'s PROCUREMENT

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G-3

APPENDIX H

INFORMATION CONCERNING UCAR'S PROCUREMENT

H-1

INFORMATION CONCERNING UCAR'S PROCUREMENT

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H-3

APPENDIX I

FINANCIAL OPERATIONS ON ALL SUPERCOMPUTERS

I-1

OPERATIONS ON ALL SUPERCOMPUTERS

Results of operations of the U.S. producers for all supercomputers are presented in table I-1. Revenue, operating income, and operating income as a percent of revenue are presented by firm in table I-2. CRI,[1] IBM, Intel, and TMC produced MPPs; CRI and SGI produced SMPs and/or SPPs. Convex provided data for all supercomputers but was unable to separate the data by the computer categories.

Aggregate net revenues, which include sales, leases, and service fees, were ***. There was a ***.

All of the companies except ***. Net sales almost doubled in interim 1997 when compared to interim 1996. All of the reporting companies except ***. Likewise, all of the reporting companies except ***.

The companies incurred combined operating losses in each period except interim 1997, during which an operating income margin of ***.

Table I-1
Results of operations of U.S. producers for all supercomputers, 1994-96, Jan.-June 1996, and Jan.-June 1997

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Table I-2
Results of operations of U.S. producers (by firm) in the production of all supercomputers, 1994-96, Jan.-June 1996, and Jan.-June 1997

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The restructuring expenses ***, as shown in the following tabulation (in thousands of dollars):

* * * * * * *

[1] ***.

I-3

APPENDIX J

EFFECTS OF IMPORTS ON PRODUCERS' EXISTING DEVELOPMENT AND PRODUCTION EFFORTS, GROWTH, INVESTMENT, AND ABILITY TO RAISE CAPITAL

J-1

Response of U.S. producers to the following questions:

1. Since January 1, 1994, has your firm experienced any actual negative effects on its return on investment or its employment, growth, investment, ability to raise capital, existing development and production efforts (including efforts to develop a derivative or more advanced version of the product), or the scale of investments as a result of imports of vector supercomputers from Japan? *** did not respond; other responses are as follows:

* * * * * * *

2. Does your firm anticipate any negative impact of imports of vector supercomputers from Japan? *** did not respond; other responses are as follows:

* * * * * * *

J-3